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1887

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BY

SIR JAMES HECTOR, K.C.M.G., M.D., F.R.S.
Director

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ERRATA.

PAGE 17, line 12, *for* "Trichophyra" *read* "Tricophrya."
Page 210, footnote, *for* "debilio" *read* "debilior."

ADDENDUM.

THE following has been received from Professor T. Jeffery Parker, as an addendum to his paper "On a Specimen of *Regalecus* recently stranded in Otago Harbour" (see pp. 20–29) :—

I regret having missed hitherto an important figure and description of *Regalecus* by Mr E. L. Layard, in the "Proceedings of the Zoological Society" for May 28th, 1868. The specimen is called *Gymnetrus capensis* (?) and was 10 feet 2 inches long. The ventral fins were perfect, and show both the terminal cutaneous expansion and the small dorsal lobe figured by Cuvier, at the junction of the middle and posterior thirds. The general features of the crest are correctly shown, and the pink spots on it are mentioned.

Everything seems to lead to the conclusion that most of the supposed species of *Regalecus* are identical, and that the more recent specific names (including *argenteus*) will have to give way, probably in favour of Ascanius's original name, *glesne*.

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NEW ZEALAND INSTITUTE.

ESTABLISHED UNDER AN ACT OF THE GENERAL ASSEMBLY OF NEW ZEALAND INTITULED "THE NEW ZEALAND INSTITUTE ACT, 1867."

BOARD OF GOVERNORS.

(EX OFFICIO.)

His Excellency the Governor. | The Hon. the Colonial Secretary.

(NOMINATED.)

The Hon. W. B. D. Mantell, F.G.S.; W. T. L. Travers, F.L.S.; Sir James Hector, K.C.M.G., M.D., F.R.S.; Ven. Archdeacon Stock, B.A.; Thomas Mason; the Hon. G. M. Waterhouse, M.L.C.

(ELECTED.)

1888.—F. B. Hutchinson, M.R.C.S.; James McKerrow, F.R.A.S.; T. Kirk, F.L.S.

MANAGER: Sir James Hector.

HONORARY TREASURER: W. T. L. Travers.

SECRETARY: R. B. Gore.

* * *

ABSTRACTS OF RULES AND STATUTES.

GAZETTED IN THE "NEW ZEALAND GAZETTE," 9TH MARCH, 1868.

SECTION I.

Incorporation of Societies.

1. No Society shall be incorporated with the Institute under the provisions of "The New Zealand Institute Act, 1867," unless such Society shall consist of not less than twenty-five members, subscribing in the aggregate a sum of not less than fifty pounds sterling annually, for the promotion of Art, Science, or such other branch of knowledge for which it is associated, to be from time to time certified to the satisfaction of the Board of Governors of the Institute by the Chairman for the time being of the Society.

2. Any Society incorporated as aforesaid shall cease to be incorporated with the Institute in case the number of the members of the said Society shall at any time become less than twenty-five, or the amount of money annually subscribed by such members shall at any time be less than £50.

3. The by-laws of every Society to be incorporated as aforesaid shall provide for the expenditure of not less than one-third of the annual revenue in or towards the formation or support of some local public Museum or Library; or otherwise shall provide for the contribution of not less than one-sixth of its said revenue towards the extension and maintenance of the Museum and Library of the New Zealand Institute.

4. Any Society incorporated as aforesaid, which shall in any one year fail to expend the proportion of revenue affixed in manner provided by Rule 3 aforesaid, shall from thenceforth cease to be incorporated with the Institute.

5. All papers read before any Society for the time being incorporated with the Institute shall be deemed to be communications to the Institute, and may then be published as Proceedings or Transactions of the Institute, subject to the following regulations of the Board of the Institute regarding publications:—

Regulations regarding Publications.

(*a.*) The publications of the Institute shall consist of a current abstract of the proceedings of the Societies for the time being incorporated with the Institute, to be intituled, "Proceedings of the New Zealand Institute," and of transactions, comprising papers read before the Incorporated Societies (subject, however, to selection as hereinafter mentioned), to be intituled, "Transactions of the New Zealand Institute."

(*b.*) The Institute shall have power to reject any papers read before any of the Incorporated Societies.

(*c.*) Papers so rejected will be returned to the Society in which they were read.

(*d.*) A proportional contribution may be required from each Society towards the cost of publishing the Proceedings and Transactions of the Institute.

(*e.*) Each Incorporated Society will be entitled to receive a *proportional* number of copies of the Proceedings and Transactions of the Institute, to be from time to time fixed by the Board of Governors.

(*f.*) Extra copies will be issued to any of the members of Incorporated Societies at the cost price of publication.

6. All property accumulated by or with funds derived from Incorporated Societies and placed in the charge of the Institute, shall be vested in the Institute, and be used and applied at the discretion of the Board of Governors for public advantage, in like manner with any other of the property of the Institute.

7. Subject to "The New Zealand Institute Act, 1867," and to the foregoing rules, all Societies incorporated with the Institute shall be entitled to retain or alter their own form of constitution and the by-laws for their own management, and shall conduct their own affairs.

8. Upon application signed by the Chairman and countersigned by the Secretary of any Society, accompanied by the certificate required under Rule No. 1, a certificate of incorporation will be granted under the Seal of the Institute, and will remain in force as long as the foregoing rules of the Institute are complied with by the Society.

SECTION II.

For the Management of the Property of the Institute.

9. All donations by Societies, Public Departments, or Private Individuals to the Museum of the Institute, shall be acknowledged by a printed form of receipt, and shall be duly entered in the books of the Institute

provided for that purpose, and shall then be dealt with as the Board of Governors may direct.

10. Deposits of articles for the Museum may be accepted by the Institute, subject to a fortnight's notice of removal to be given either by the owner of the articles or by the Manager of the Institute, and such deposits shall be duly entered in a separate catalogue.

11. Books relating to Natural Science may be deposited in the Library of the Institute, subject to the following conditions:—

(*a.*) Such books are not to be withdrawn by the owner under six months' notice, if such notice shall be required by the Board of Governors.

(*b.*) Any funds specially expended on binding and preserving such deposited books, at the request of the depositor, shall be charged against the books, and must be refunded to the Institute before their withdrawal, always subject to special arrangements made with the Board of Governors at the time of deposit.

(*c.*) No books deposited in the Library of the Institute shall be removed for temporary use, except on the written authority or receipt of the owner, and then only for a period not exceeding seven days at any one time.

12. All books in the Library of the Institute shall be duly entered in a catalogue, which shall be accessible to the public.

13. The public shall be admitted to the use of the Museum and Library, subject to by-laws to be framed by the Board.

SECTION III.

The Laboratory shall, for the time being, be and remain under the exclusive management of the Manager of the Institute.

SECTION IV.

OF DATE 23RD SEPTEMBER, 1870.

Honorary Members.

Whereas the rules of the Societies incorporated under the New Zealand Institute Act provide for the election of Honorary Members of such Societies, but inasmuch as such Honorary Members would not thereby become members of the New Zealand Institute, and whereas it is expedient to make provision for the election of Honorary Members of the New Zealand Institute, it is hereby declared –

1st. Each Incorporated Society may, in the month of November next, nominate for election as Honorary Members of the New Zealand Institute three persons, and in the month of November in each succeeding year, one person, not residing in the colony.

2nd. The names, descriptions, and addresses of persons so nominated, together with the grounds on which their election as Honorary Members is recommended, shall be forthwith forwarded to the Manager of the New Zealand Institute, and shall by him be submitted to the Governors at the next succeeding meeting.

3rd. From the persons so nominated, the Governors may select in the first year not more than nine, and in each succeeding year not more than three, who shall from thenceforth be Honorary Members of the New Zealand Institute, provided that the total number of Honorary Members shall not exceed thirty.

LIST OF INCORPORATED SOCIETIES.

NAME OF SOCIETY.	DATE OF INCORPORATION.
WELLINGTON PHILOSOPHICAL SOCIETY	10th June, 1868.
AUCKLAND INSTITUTE	10th June, 1868.
PHILOSOPHICAL INSTITUTE OF CANTERBURY	22nd October, 1868.
OTAGO INSTITUTE	18th October, 1869.
WESTLAND INSTITUTE	21st December, 1874.
HAWKE'S BAY PHILOSOPHICAL INSTITUTE	31st March, 1875.
SOUTHLAND INSTITUTE	21st July, 1880.
NELSON PHILOSOPHICAL SOCIETY	20th December, 1883.

OFFICERS OF INCORPORATED SOCIETIES, AND EXTRACTS FROM THE RULES.

WELLINGTON PHILOSOPHICAL SOCIETY.

OFFICE-BEARERS FOR 1888:—*President*—W. M. Maskell, F.R.M.S.; *Vice-presidents*—Hon. G. R. Johnson, M.L.C., A. de B. Brandon; *Council*—Charles Hulke, F.C.S., A. K. Newman, M.B., M.R.C.P., R. H. Govett, Sir James Hector, K.C.M.G., M.D., F.R.S., W. T. L. Travers, F.L.S., A. McKay, F.G.S., E. Tregear, F.R.G.S.; *Secretary and Treasurer*—R. B. Gore; *Auditor*—W. E. Vaux.

Extracts from the Rules of the Wellington Philosophical Society.

5. Every member shall contribute annually to the funds of the Society the sum of one guinea.

6. The annual contribution shall be due on the first day of January in each year.

7. The sum of ten pounds may be paid at any time as a composition for life of the ordinary annual payment.

14. The time and place of the General Meetings of members of the Society shall be fixed by the Council and duly announced by the Secretary.

AUCKLAND INSTITUTE.

OFFICE-BEARERS FOR 1888:—*President*—S. Percy Smith, F.R.G.S.; *Vice-presidents*—Professor F. D. Brown, B.Sc., Professor A. P. Thomas, F.L.S.; *Council*—C. Cooper, Rev. E. H. Gulliver, M.A., Hon. Colonel Haultain, E. A. Mackechnie, J. Martin, F.G.S., T. Peacock, M.H.R., Rev. A. G. Purchas, M.R.C.S.E., Rev. W. Tebbs, J. B. Russell, J. A. Pond, Mr. Justice Gillies; *Secretary and Treasurer*—T. F. Cheeseman, F.L.S., F.Z.S.; *Auditor*—J. Stewart.

Extract from the Rules of the Auckland Institute

1. Any person desiring to become a member of the Institute shall be proposed in writing by two members, and shall be ballotted for at the next meeting of the Council.

4. New members on election to pay one guinea entrance-fee, in addition to the annual subscription of one guinea, the annual subscriptions being payable in advance on the first day of April for the then current year.

5. Members may at any time become life members by one payment of ten pounds ten shillings, in lieu of future annual subscriptions.

10. Annual General Meeting of the Society on the third Monday of February in each year. Ordinary Business Meetings are called by the Council from time to time.

PHILOSOPHICAL INSTITUTE OF CANTERBURY.

OFFICE-BEARERS FOR 1888 :—*President*—Professor F. W. Haslam, M.A.; *Vice-presidents*—G. Hogben, M.A.; S. Hurst-Seager, A.R.I.B.A.; *Hon. Treasurer*—H. R. Webb, F.R.M.S.; *Hon. Secretary*—W. Dinwiddie; *Hon. Auditor* C. R. Blakiston; *Council*—Professor Hutton, F.G.S., R. W. Fereday, F.G.S., T. Crook, Professor C. H. H. Cook, M.A., W. H. Symes, M.D., R. M. Laing, M.A.

Extracts from the Rules of the Philosophical Institute of Canterbury.

21. The Ordinary Meetings of the Institute shall be held on the first Thursday of each month during the months from March to November inclusive.

35. Members of the Institute shall pay one guinea annually as a subscription to the funds of the Institute. The subscription shall be due on the first of November in every year. Any member whose subscription shall be twelve months in arrear shall cease to be a member of the Institute, but he may be restored by the Council if it sees fit.

37. Members may compound for all annual subscriptions of the current and future years by paying ten guineas.

OTAGO INSTITUTE.

OFFICE-BEARERS FOR 1888: *President*—Alex. Wilson, M.A.; *Vice-presidents*—F. R. Chapman, Dr. de Zouche; *Hon. Secretary*—G. M. Thomson, F.L.S.; *Hon. Treasurer*—J. C. Thomson; *Council*—D. Petrie, M.A., Professor Scott, C. Chilton, M.A., Dr. Hocken, Rev. H. Belcher, LL.D., Professors Parker and Gibbons; *Auditor*—D. Brent, M.A.

Extracts from the Constitution and Rules of the Otago Institute.

2. Any person desiring to join the Society may be elected by ballot, on being proposed in writing at any meeting of the Council or Society by two members, and on payment of the annual subscription of one guinea for the year then current.

5. Members may at any time become life-members by one payment of ten pounds and ten shillings in lieu of future annual subscriptions.

8. An Annual General Meeting of the members of the Society shall be held in January in each year, at which meeting not less than ten members must be present, otherwise the meeting shall be adjourned by the members present from time to time, until the requisite number of members is present.

(5.) The session of the Otago Institute shall be during the winter months from May to October, both inclusive.

WESTLAND INSTITUTE.

Office-bearers for 1888.—*President*—Rev. H. G. Gould; *Vice-president*—Jno. Nicholson; *Treasurer*—A. H. King; *Committee*—J. N. Smythe, R. Cross, C. F. A. Broad, M. L. Moss, G. J. Roberts, E. B. Sammons, J. W. Souter, Captain Bignell; G. Clarkson, J. P. Will; *Secretary*—Henry Weston.

Extracts from the Rules of the Westland Institute.

3. The Institute shall consist.—(1) Of life-members, *i.e.*, persons who have at any one time made a donation to the Institute of ten pounds ten shillings or upwards, or persons who, in reward of special services rendered to the Institute, have been unanimously elected as such by the Committee or at the general half-yearly meeting. (2) Of members who pay two pounds two shillings each year. (3) Of members paying smaller sums, not less than ten shillings.

5. The Institute shall hold a half-yearly meeting on the third Monday in the months of December and June.

HAWKE'S BAY PHILOSOPHICAL INSTITUTE.

Office-bearers for 1888:—*President*—W. Colenso, F.R.S., F.L.S.; *Vice-president*—J. Goodall, C.E.; *Council*—R. C. Harding, H. Hill, W. I. Spencer, R. Lamb, T. C. Moore, W. Wood; *Hon. Secretary, Treasurer, and Curator of Museum*—A. Hamilton; *Auditor*—T. K. Newton.

Extracts from the Rules of the Hawke's Bay Philosophical Institute.

3. The annual subscription for each member shall be one guinea, payable in advance on the first day of January in every year.

4. Members may at any time become life-members by one payment of ten pounds ten shillings in lieu of future annual subscriptions.

(4.) The session of the Hawke's Bay Philosophical Institute shall be during the winter months from May to October, both inclusive; and general meetings shall be held on the second Monday in each of those six months, at 8 p.m.

SOUTHLAND INSTITUTE.

Office-bearers for 1887:—*President*—Ven. Archdeacon Stocker; *Vice-president*—A. Highton, B.A.; *Council*—Messrs. Bailey, McLean, C. Tanner, Dr. Galbraith, and Dr. Closs; *Treasurer*—E. Robertson; *Secretary*—E. Webber.

NELSON PHILOSOPHICAL SOCIETY.

Office-bearers for 1888.—*President*—Dr. L. Boor, ; *Vice-presidents*—The Bishop of Nelson and A. S. Atkinson ; *Secretary*—Dr. Coleman ; *Treasurer*—Dr. Hudson ; *Council*—Dr. Mackie, J. Holloway, Dr. Cressey, G. Ashcroft, and R. T. Kingsley ; *Curator*—R. T. Kingsley.

Extracts from the Rules of the Nelson Philosophical Society

4. That members shall be elected by ballot.

6. That the annual subscription shall be one guinea.

7. That the sum of ten guineas may be paid in composition of the annual subscription.

16. That the meetings be held monthly.

28. The papers read before the Society shall be immediately delivered to the Secretary.

TRANSACTIONS.

TRANSACTIONS

OF THE

NEW ZEALAND INSTITUTE,

1887.

I.—ZOOLOGY.

ART. I.—*On the Freshwater Infusoria of the Wellington District.*

By W. M. MASKELL, F.R.M.S.

[*Read before the Wellington Philosophical Society, 30th November,* 1887.]

PLATES I., II., III., IV.

THE following paper is in continuation of that published in vol. xix. of the "Transactions," and contains some of the observations made since last year by the Microscopical Section of the Wellington Philosophical Society, Messrs. W. F. Barraud, A. Brandon, C. P. Powles, T. W. Kirk, and the writer.

As before, the work has been strictly confined to "freshwater" types. Most of the animals herein considered as new belong to recognised genera: the exception being *Thurophora lucens*, which seemed undoubtedly to present sufficiently clear generic differences.

In the "Journal of the Royal Microscopical Society" for February, 1887, Professor A. C. Stokes, of New Jersey, in an account of some new American Infusoria, remarks that it is rare to find in America forms which are also found in European fresh water. The experience of the compilers of the present paper leads to quite the contrary view, as regards the New Zealand animalcules. Probably the ambition of every "systematic" observer in any branch of Zoology or Botany is to discover some new species: and this, laudable as it doubtless is to a proper extent, has unfortunately led to a multiplication of specific distinctions and names, often on the slenderest grounds, which subsequent investigation will have to largely diminish, at some trouble to students. The members of the Wellington Microscopical Section have steadily endeavoured to resist this tendency, believing that much less error and confusion will result by neglecting the frequently most minute differences from European types observable in almost every Infusorian examined. Examples of this may be found in such forms as *Rhipidodendron* *huxleyi*, *Amphileptus anser*, *Metopus sigmoides*, in our former paper, or *Monas irregularis*, *Codosiga botrytis*, etc., in the present one. There are certainly minute points of difference in such as these which might tempt some observers to raise them, if not to specific, at least to "variety," rank. But, in truth, there is very often no absolute stability even in the same individuals amongst the Infusoria; and we have thought it best to avoid to the utmost any more cumbering of scientific classification and nomenclature than was absolutely necessary. The couple of dozen animalcules herein set down as new species are considered to be sufficiently deserving of the distinction.

But Professor Stokes's statement as to the New Jersey Infusoria, compared with what has just been said, raises a question as to the reason for the identities observed between the New Zealand and the European forms. It may be remarked that similar identities appear to be noticeable also amongst the freshwater Algæ, as several of our Desmidieæ and Diatomaceæ are found at both sides of the globe, and many others present differences so trifling as to be unimportant. That specific similarity should be so rare as Professor Stokes declares it between two countries in the same hemisphere, as New Jersey and France or England, and so frequent in two so nearly antipodal as England and New Zealand, is not a little curious; and it becomes still more so if, as seems to be the case, the differences in the "higher" zoological and botanical orders and families are in a reverse ratio. The "higher" American fauna and flora approximate to the European much more than the New Zealand fauna and flora do. It is, therefore, not quite clear why the microscopical forms of animal and vegetable life should not follow the same lines. The answer might, possibly, be found in an extension of research, leading to comparisons between countries of about the same latitude and climate. Yet New Jersey, France, and New Zealand, are not, in these respects, very differently situated.

CATALOGUE OF INFUSORIA.

Class I. FLAGELLATA.

Order. FLAGELLATA-PANTOSTOMATA.

Genus **Monas.**

Monas irregularis, Perty. Wellington, Hutt Valley, Wainui, Karori.

Monas claviculus, sp. nov. Plate I., fig. 1, *a*, *b*.

Body elongate, rounded and broad anteriorly, tapering to a point posteriorly, plastic and variable in form, nearly five times longer than broad when extended; surface punctate except at the anterior end, where there is a smooth area. Contractile vesicle single, sub-central. Flagellum single, as long as the extended body. Colour white; motion rather slow.

Length $\frac{1}{860}$ inch = 29 μ, extended.

Hutt Valley, *W. M. Maskell.*

The posterior tapering, smooth anterior area, and general nail-shaped form distinguish this animalcule.

Genus **Oikomonas.**

Oikomonas termo, James-Clark. Wellington.

Genus **Dendromonas.**

Dendromonas producta, sp. nov. Plate I., fig. 2, *a*, *b*.

Animalcules rounded posteriorly; anterior border oblique, slightly concave, produced at the angles to a point, which is more or less visible according to the position of the animalcule (fig. 2, *b*). Zoodendrium slender, translucent, erect, irregularly branched but usually only dichotomous at the tip of the main rachis. Flagella two, uneven in length. Contractile vesicle single, sub-central. Endoplast posterior.

Average total length of zoodendrium $\frac{1}{280}$ inch = 90 μ; main rachis usually longer than the branches. Length of zooids $\frac{1}{4500}$ inch = 5·7 μ.

Otaki, *W. M. Maskell.*

The known species of this genus are all more or less pyriform, and show nothing of the oblique concave anterior edge with produced angles of this species.

Genus **Cephalothamnium.**

Cephalothamnium coronatum, sp. nov. Plate I., fig. 3.

Animalcules elongate-ovate, situated in a cluster at the extremity of a long, slender, stiff, translucent pedicle: as many as twenty sometimes in a cluster. Flagella two, unequal in length. Near the bases of the flagella is a ring or coronet of very minute granules, sometimes almost like spines. Contractile vesicle single, sub-central. Endoplast not observed.

Average length of pedicle, $\frac{1}{360}$ inch = 70 μ; length of zooids, $\frac{1}{2500}$ inch = 10 μ.

Hutt Valley, *W. M. Maskell.*

The "coronet" of gemmules clearly distinguishes this species.

Genus **Stylobryon.**

Stylobryon petiolatum, De Fromentel. Karori; Otaki.

Genus **Goniomonas.**

Goniomonas elongata, sp. nov. Plate I., fig. 4, *a*, *b*, *c*.

Animalcules free-swimming, elongate, sub-triangular or sub-rectangular according to position, persistent in shape; colour white or grey, translucent, with numerous greenish granules. Anterior border obliquely truncate, slightly concave. Flagella two, springing from the projecting angle, sub-equal in length. Contractile vesicle single, somewhat posterior. Motion rather rapid.

Length $\frac{1}{1080}$ inch = 28·8 μ.

Wellington, Hutt Valley, Karori, Otaki, *W. M. Maskell.*

Wants the dark, band-like spot of *G. truncata*, Fres., and the position of the contractile vesicle and generally more elongated form distinguish it.

Genus **Rhipidodendron.**

Rhipidodendron splendidum, Stein. Hutt Valley.

The points noted as differentiating this from *R. huxleyi*, reported in our paper of 1886, are the number of tubes in the branching zoodendrium (seven to ten), their not being in the same plane, and the protrusion of the animalcules in some cases almost entirely beyond the tube-orifices, just as those delineated in Saville Kent's Plate XVI., fig. 1. Curiously, Kent himself says that in *R. splendidum* the animalcules have "their flagella only projecting;" and he proceeds to figure, as just stated, the animalcules themselves protruded; so that one is apt to be puzzled by the contradiction. The number of tubes, and their situation in different planes, are taken as sufficient distinctions herein. A further character may be the irregularity of the bifurcations as compared with *R. huxleyi.*

Order. CHOANO-FLAGELLATA.

Genus **Monosiga.**

Monosiga brevipes, Kent. Hutt Valley; on stems of *Vorticella.*

Genus **Codosiga.**

Codosiga botrytis, Ehrenb. Wellington.

The only differences that close examination revealed between this and the European species were that the colonies were much less frequent, and the individuals of each less numerous, in the New Zealand form.

Genus **Salpingœca.**

Salpingœca inquillata, Kent. Plate I., fig. 5.

A species only reported from salt-water in Europe. A figure is given to show how closely the Wellington form approximates to the European. The specimens were, however, collected not far from the sea-shore, though in apparently quite fresh water.

Length of lorica, $\frac{1}{2500}$ inch = 10 μ.

Wellington, *A. Brandon.*

Salpingœca steinii, Kent. (var. ?). Plate I., fig. 6.

Agrees with Kent's species in everything but size, but was found attached to *Myriophyllum* and not to aquatic animals. It forms rosette-shaped clusters. Note that Kent's measurements (Vol. I., p. 346)—"length of lorica, $\frac{1}{800}$ inch"—must be a misprint, or else the figures in his Plate V. are inexact.

Length of lorica, $\frac{1}{2000}$ inch = 12·5 μ.

Hutt Valley, *W. F. Barraud.*

Order. FLAGELLATA-EUSTOMATA.

Genus **Trachelomonas.**

Trachelomonas hispida, Perty. Wellington.

The New Zealand form seldom shows any neck.

Trachelomonas teres, sp. nov. Plate I., fig. 7.

Lorica evenly elliptical, quite smooth; colour yellow, or reddish-yellow, with a dark-red border; neck represented by a thin ring, the aperture much wider than is usual in the genus. Animalcule greenish.

Length of lorica, $\frac{1}{750}$ inch = 35 μ.

Hutt Valley, *W. M. Maskell.*

Distinct, but nearest perhaps to *T. lagenella*.

Trachelomonas cylindrica, Ehrenb. Otaki.

Genus **Anisonema.**

Anisonema grande, Ehrenb. Wellington.

Anisonema ovatum, sp. nov. Plate I., fig. 8, *a*, *b*.

Animalcules usually free-swimming; evenly ovate when viewed in any direction; colour, white. Flagella springing from points within the anterior edge, ventrally, close to each other and to the pharynx, which is long, narrow, and distinct; anterior flagellum thinner than the posterior one, and about half as long. Contractile vesicle situated near the bases of the flagella. Motion oscillatory, gliding forward.

Length of body, $\frac{1}{1250}$ inch = 20 μ; length of posterior flagellum, about $\frac{1}{800}$ inch.

Otaki, Wellington, *W. M. Maskell.*

Distinguished by the evenly ovate form in all positions.

Order. CILIO-FLAGELLATA.

Genus **Gymnodinium.**

Gymnodinium varians, sp. nov. Plate I., fig. 9, *a*, *b*.

Animalcules free-swimming, without a cuirass; slightly variable in form, as shown in the figures; body usually as in (*a*), with conoidal segments equally tapering, sometimes as in (*b*), with globular segments. Colour green. Transverse and longitudinal furrows, and belt of cilia, normal of the genus. Flagellum long, slender.

Length, $\frac{1}{1400}$ inch = 17 μ.

Hutt Valley, *W. M. Maskell.*

Allied to *G. pulvisculus*, Ehrenb.

Gymnodinium fuscum, Ehrenb. Masterton.

Class II. CILIATA.

Order. HOLOTRICHA.

Genus **Nassula.**

Nassula ambigua, Stein., var. *tumida*, var. nov. Plate I., fig 10.

Animalcules free-swimming, flexible, evenly elliptical, cuticle covered with fine cilia. Colour yellow; the ingested food-particles green or brown. Pharynx very large, tumid, dilated at the middle, slightly inclined, situated near the anterior edge; pharyngeal rods conspicuous. Contractile vesicle single, subcentral, situated somewhat posteriorly.

Length, $\frac{1}{240}$ inch = 105 μ.

Hutt Valley, *W. M. Maskell.*

This form is rounder and more regular than the European species, and the pharynx is larger and more tumid in the middle.

Genus **Choenia.**

Choenia crassa, sp. nov. Plate I., fig. 11, *a*, *b*.

Animalcules free-swimming. Colour brownish-white; not highly extensile but plastic and flexible; vermiform, tapering slightly anteriorly, more so posteriorly; cuticle finely ciliate. Anterior margin a little dilated and rounded, the oral aperture situated at the apex, followed by a narrow alimentary canal, capable of great distension, as shown in fig. 11, *b*. Contractile vesicles twelve or more, situated along one side. Adoral cilia somewhat longer than the rest.

Length variable, from $\frac{1}{30}$ inch = 888 μ to $\frac{1}{40}$ inch = 625 μ.

Wellington, Hutt Valley, Wainui, Karori, *W. M. Maskell.*

The European *C. teres* has a salt-water habitat, and is more slender and much more elastic than this species. *Trachelius striatus*, Dujardin, is apparently somewhat similar, but seems to be nearly identical with *C. teres*.

The distension of the oral aperture and canal, shown in fig. 11, *b*, was observed on one occasion while the animalcule was engaged in devouring another infusorian, *Urocentrum turbo*, which is here represented as passing head foremost into the mouth. The process, which is apparently similar in the European species, resembles that of a snake, the canal being distended gradually as the food passes down it. The deglutition of *Urocentrum* on the occasion observed occupied about ten seconds.

Genus **Amphileptus.**

Amphileptus irregularis, sp. nov. Plate I., fig. 12.

Animalcules free-swimming, elastic; colour whitish; body elongate, tapering posteriorly to a point and produced anteriorly in a very slender recurved neck about two-thirds as long as the body; margins irregular and rough. Oral aperture situated in a conspicuous depression at the base of the neck-region. Cuticle finely ciliated throughout. Contractile vesicles numerous along one edge; nucleus globular, close to the posterior extremity. Surface granular, with many ingested food-particles.

Average length, $\frac{1}{150}$ inch = 166 μ; length of neck-region about $\frac{1}{400}$ inch = 62 μ.

Wellington, Hutt Valley, Otaki, *W. M. Maskell.*

This might be put into a group with *A. gigas*, Clap. and Lachm.; but it is much smaller and rougher, and the neck-region is different.

Amphileptus rotundus, sp. nov. Plate II., fig. 13.

Animalcules free-swimming; colour whitish, tinged with brown; many dark ingested food-particles. Cuticle finely ciliated throughout. Body elliptical, slightly pointed posteriorly, produced anteriorly in a very short, thick, curved neck; surface exhibiting many granules except on the neck-region. Oral aperture situated near to but not exactly at the base of the neck, followed by a simple, tubular pharynx. Contractile vesicles numerous. Endoplast elongate, sub-central.

Length, exclusive of the neck, $\frac{1}{250}$ inch = 100 μ; length of neck, $\frac{1}{950}$ inch = 27 μ.

Lyall Bay, *W. F. Barraud.*

Near to *A. vorax*, Ehrenb., but differs in the position of the oral aperture and the form of the nucleus. It is also only half as large. The number of contractile vesicles could not be accurately determined, owing to the quantity of dark food-particles in all the specimens examined.

Amphileptus tracheloides, sp. nov. Plate II., fig. 14, *a*, *b*.

Animalcules free-swimming, plastic but persistent in form; colour white, with a great number of large black particles all over the body (food ?); cuticle finely ciliate throughout. Body regularly elliptical under one aspect; pyriform under another, and tapering anteriorly, but not produced into a distinct neck-region. Oral aperture situated near the anterior edge, apparently followed by a conical simple pharynx. Contractile vesicle large, single, sub-central. Endoplast not observed. All details are extremely difficult of observation, on account of the immense number of black globular particles apparently filling the body. Motion rapid, rolling on the longer axis.

A kind of temporary encystment is frequently to be observed in this species: the animalcules encyst themselves without apparently any particular object, protective or reproductive. An animalcule will slacken the speed of its progress through the water, the motion becoming slower and slower, but very gradually; as it approaches a state of rest it will become quite spherical and surround itself with an apparently mucous, translucent, globular sheath. After perhaps half or three-quarters of an hour all motion will have ceased, except that of the cilia, which slowly vibrate. After awhile (from a few minutes to an hour) the rolling motion will gradually recommence, become by degrees more and more rapid, and at length reach again the normal speed; the animalcule regains its elliptical form and travels as before until it chooses to repeat the process just described. The object of these proceedings is not clear.

Length, $\frac{1}{120}$ inch = 200 μ.

Otaki, Hutt Valley, Wellington, *W. M. Maskell.*

A peculiar species, of large size; approaching in its pyriform aspect somewhat *Trachelius ovum*; but the black particles prevent any observation of vacuolar reticulations. *Trachelius* also seems never to present an evenly elliptical form.

Order. HETEROTRICHA.

Genus **Stentor.**

Stentor attenuatus, sp. nov. Plate II., fig. 15, *a*, *b*, *c*.

Body very highly extensile; colour blueish-green; conspicuously striated; excessively slender when fully extended, the stem often becoming as thin as the pedicle of a *Vorticella*. Peristome narrow, wine-glass shaped, small, the edge scarcely or not at all recurved; edge irregular or wavy, with a small spiral involution. Parenchyma containing several dark granular masses. Contractile vesicle single, situated below the peristome edge, often exhibiting a short attached canal. Endoplast moniliform. Peristomal cilia long; the body and stem clothed with short fine cilia. Body when free-swimming usually elongate (fig. 15, *b*), pointed posteriorly, conspicuously striated, exhibiting the spiral involution of the peristome; sometimes globular (fig. 15, *c*). A commencement of reproduction by fissure was observed on one occasion in the fringe, shown in fig. 15 at *d*.

Length of peristome (average), $\frac{1}{60}$ inch = 417 μ; width, $\frac{1}{30}$ inch = 812 μ. Length of stem when fully extended reaching sometimes $\frac{1}{3}$ inch = 8125 μ.

Wellington, *C. P. Powles.*

The remarkable slenderness and great length of the stem clearly distinguish this species. In some specimens examined the stem became, near its base, almost hair-like, with scarcely any dilation until at the commencement of the peristome. The bluoish-green colour, conspicuous striæ, and scarcely-expanded peristome-edge are also distinctive. The fringe above mentioned, denoting approaching division, is a character delineated also in *Stentor polymorphus*, Muller (Kent, Pl. XXX., fig. 14).

Genus **Tintinnidium.**

Tintinnidium fluviatile, Stein, var. *emarginatum*, var. nov. Plate III., fig. 16, *a*, *b*, *c*, *d*.

Animalcules excreting a cylindrical, gelatinous tube or lorica, attached by its base to aquatic plants, or rarely to stems of *Zoothamnium* or *Epistylis;* at times free-swimming. Lorica transparent, but usually covered by a quantity of vegetable or other particles adhering to it. Animalcule white, campanulate, attached to the base of the tube by a slender, highly-retractile pedicle; when fully extended reaching only to the mouth of the tube, or projecting very slightly beyond it. Peristome occupying almost all the width of the tube, the edge not at all, or very slightly, recurved. Peristome-edge on one side entire, bearing a number of long, thick, cirrose cilia; the other side bearing very few, shorter, cirrose cilia, and apparently cleft into three divisions, the middle one bearing no cilia; this median division pulsates regularly up and down as on a hinge. On the anterior portion of the body, below the peristome-edge, are a few short, straight, fine setæ placed at right angles to the margin; possibly, if the tube permitted full examination, these might be seen to extend to the pedicle. Contractile vesicle single, spherical, situated a little below the peristome-edge. Nucleus not observed.

Animalcules may frequently be seen unattached within their tubes, as in fig. 16, *a* (the right-hand figure); they then escape at pleasure from the tube and become free-swimming, in the form shown in fig. 16, *c*, when they may easily be mistaken for free *Vorticella*. In the end-view of such a form the adoral cilia are seen to be disposed spirally (fig .16, *d*) as in *Strombidium*, and the motion is rapidly rolling.

Food-particles appear to be taken in at the two small clefts on one side of the peristome-edge, shown in fig. 16, *b*, and the pulsating middle division seems to act after the manner of a valve.

The structural details above given are not easily observed on account of the covering of foreign particles on the lorica, and the fact that the animalcule scarcely protrudes beyond the orifice of the tube. Sometimes, however, a lorica less thickly coated permits fairly close observation.

Length of animalcule, including pedicle, $\frac{1}{250}$ inch = 100 μ.

Saville Kent makes no mention of any divisions on the peristome-edge of *T. fluviatile*, and his description of that species is by no means full. In *T. semiciliatum*, Sterki, he mentions both a "cleft" oral region and a "lip- or tongue-like organ." But he seems doubtful whether Sterki's form is not really the same as Stein's. The main character of *T. semiciliatum*, if quite certain, is the pectinate form of the adoral cilia. This is not noticeable in our New Zealand animalcule. On the whole, it seems possible that all the freshwater species of this genus may be identical, and the present is only offered as a "variety," subject to future revision. No species of *Tintinnidium* seems to have been reported anywhere else since the publication of Kent's monograph.

Order. PERITRICHA.

Genus **Strombidium.**

Strombidium intermedium, sp. nov. Plate III., fig. 17, *a*, *b*, *c*.

Animalcules free-swimming, ovoid, with a short posterior prolongation; colour whitish, with enclosed granules; about one and a half times longer than broad; anterior border rounded, posterior projection tapering nearly to a point. On the anterior portion is a ring of long, fine cilia, which in end-view (fig. 17, *b*) are seen to be disposed spirally. Contractile vesicle single, close to the posterior projection. Nucleus elongate-oval, placed diagonally below the ring of cilia. No cilia on any part except in the ring. Motion excessively rapid, jerking, and difficult to follow.

An example observed of reproduction by fission is shown in fig. 17, *c*; the two bodies are at right angles to each other.

Length, $\frac{1}{287}$ inch = 88·5 μ.

Otaki, *W. M. Maskell.*

Intermediate between *S. claparedii*, Kent, and *S. gyrans*, Stokes.*

Genus **Mesodinium.**

Mesodinium phialinum, sp. nov. Plate III., fig. 18, *a*, *b*.

Animalcules free-swimming, shaped like a small jar or bottle, divided unequally by a ring, at the base of which are a number of longish, straight, fine cilia, which in end-view (fig. 18, *b*) are seen to be disposed as rays, not spirally; above the ring the body is prolonged in a sub-conical projection, deeply concave at the top. Contractile vesicle single, spherical, placed posteriorly. Nucleus small, spherical, sub-central. Motion excessively rapid, rotatory, varied by violent leaps and jerkings.

Length, including projection, $\frac{1}{1400}$ inch = 17·8 μ.

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* "Quart. Journ. Roy. Micros. Soc.," Feb., 1887, p. 87.

Otaki, in company with *Strombidium*, *W. M. Maskell.*

This form is more angular and jar-shaped than *M. acarus*, Stein. *M. recurvum*, Kellicott,[*] has two rings of cilia. *M. fimbriatum*, Stokes,[†] has cilia with divided ends.

Genus **Carchesium.**

Carchesium polypinum, Linn. Hutt Valley.

Genus **Zoothamnium.**

Zoothamnium limpidum, sp. nov. Plate III., fig. 19, *a*, *b*.

Animalcules regularly campanulate, similar in shape and size when expanded; surface smooth; colour white; placed on branches of a long, thick, quite smooth retractile pedicle, the whole contracting together (the muscular fibre being continuous, Fig. 19, *b*); peristome-edge of medium thickness, slightly recurved. Contractile vesicle single, sub-central. Nucleus doubtful. The pedicle is, proportionately, a good deal longer than usual in the genus.

Length of bodies, about $\frac{1}{300}$ inch = 83 μ. Pedicle sometimes nearly $\frac{1}{10}$ inch long before branching.

Wellington, *C. P. Powles.*

The general smoothness and clearness of the whole zoodendrium, and the comparatively great length of the pedicle, distinguish this form.

Genus **Epistylis.**

Epistylis anastatica, Linn. Hutt Valley; parasitic on *Daphnia pulex*.

Genus **Opercularia.**

Opercularia nutans, Ehrenb. Wellington.

Genus **Thuricola.**

Thuricola valvata, Wright. Hutt Valley.

Genus **Cothurnia.**

Cothurnia parallela, sp. nov. Plate III., fig. 20.

Lorica transparent, sub-cylindrical, never ovate, the margin sometimes everted, sides straight and parallel; pedicle always very short, smooth, and slender. Animalcules not occupying all the width, and projecting when extended nearly half their length; colour white; peristome-edge not recurved. Contractile vesicle single, situated below the peristome; nucleus elongated, sub-central.

Length of lorica, $\frac{1}{250}$ inch = 100 μ (including pedicle); length of pedicle, $\frac{1}{6000}$ inch = 4 μ.

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[*] "Proc. Amer. Soc. Micros.," 1885.

[†] "Journ. Roy. Micros. Soc.," Feb., 1887.

On *Confervæ*, Hutt Valley, *W. M. Maskell.*

Nearest, perhaps, to *C. imberbis*, Ehrenb., but the form of the lorica is quite different.

Cothurnia amphorella, sp. nov. Plate III., fig. 21.

Lorica transparent, vase-shaped, ovate posteriorly, tapering regularly to the margin, which is narrow and not everted; pedicle very short and slender. Animalcule whitish, occupying about half the width of the ovate portion of the lorica and all the margin, but not projecting when extended except by the peristome-edge, which is rather thick and slightly recurved. Contractile vesicle single, below the peristome; nucleus elongate, sub-central.

Length of lorica (including pedicle), $\frac{1}{380}$ inch = 66 μ; length of pedicle, $\frac{1}{2880}$ inch = 8·8 μ.

On *Confervæ*, Lyall Bay, *W. F. Barraud.*

The form of the lorica, and the fact that the animalcules do not project beyond the margin, distinguish this species.

Genus **Platycola.**

Platycola decumbens, Ehrenb., var. *intermedia*, var. nov. Plate III., fig. 22.

Lorica dark-brown, smooth, oval, decumbent on aquatic plants, produced anteriorly in a very short bent neck, of which the margin is simple and not at all recurved. Animalcule white, protruding when extended nearly half its length beyond the orifice of the lorica. Peristome-edge and ciliary disc not much wider than the body. Contractile vesicle single; nucleus not sufficiently observed. Very often two animalcules (as in fig. 22) occupy the same lorica.

Length of lorica about $\frac{1}{200}$ inch = 125 μ.

Wellington, *C. P. Powles.*

This variety is rather larger than Ehrenberg's original form, and has a distinct neck, which is much shorter and less recurved than in *P. longicollis*, already reported (1886).

Order. HYPOTRICHA.

Genus **Phascolodon.**

Phascolodon elongatus, sp. nov. Plate III., fig. 23.

Animalcules free-swimming, persistent in shape but frequently bending upwards at the anterior end; more or less shovel-shaped, broad in front, tapering posteriorly to a point; colour white; ventral surface concave and ciliated; dorsal surface much inflated over half its area from the posterior end, not ciliated; cuticle distinctly striated. Pharynx sub-central, tubular, with conspicuous rods. Contractile vesicles two, one on each side of the pharynx. Nucleus round, placed close to the posterior extremity.

Length $\frac{1}{140}$ inch = 181 μ.

Wellington, *W. M. Maskell.*

Longer and narrower than *P. vorticella*, Stein, and differing also in the positions of the nucleus and the contractile vesicles.

Genus **Ægyria.**

Ægyria astyla, sp. nov. Plate IV., fig. 24.

Animalcules free-swimming, persistent in shape; seeming as if bivalved; colour brownish; ventral surface concave, edge furnished with long cilia; dorsal surface convex, not ciliated. Valves narrow, slightly widened posteriorly. Contractile vesicles two; nucleus not observed. No anal style. No pigment-spot.

Length, $\frac{1}{360}$ inch = 70 μ; average width of valve, $\frac{1}{1450}$ inch 17·5 μ.

Pahautanui, *W. M. Maskell.*

Most of the species of this genus inhabit salt water. *Ægyria fluviatilis*, Stein, the only freshwater form reported from Europe, appears to be conspicuously ribbed. The presence of an anterior pigment-spot is noticed in one European species, *Ægyria oliva*, C. and L.

Ægyria distyla, sp. nov. Plate IV., fig. 25.

Animalcules free-swimming, as if bi-valved, the valves a good deal broader than in the last species; colour brownish-yellow; ventral surface concave, edge furnished with long cilia. A pigment-spot noticeable at the anterior end. At the posterior extremity two short, sharply triangular styles. Contractile vesicle single, sub-central.

Length, $\frac{1}{360}$ inch 70 μ; average width of valve, $\frac{1}{700}$ inch = 35 μ.

Hutt Valley, *W. F. Barraud.*

In general contour this resembles *Æ. oliva*, an European saltwater species, but differs in the double anal styles and the single contractile vesicle.

Genus **Thurophora**, gen. nov. (Gr. θύρα, a door).

Animalcules free-swimming, encuirassed; oral region partly closed by a vibratile, apparently hinged, membrane.

This genus is placed here in the order Hypotricha, because, although in the only species observed there are some short cilia on the dorsal surface, these differ greatly from the long ventral cilia which alone appear to have any locomotive character. The animalcules are, however, sufficiently anomalous to render it somewhat difficult to know where they should strictly be placed. The hinged membrane differs from the extensile pouch of

Cyclidium or *Pleuronema* (Holotrichous) in being never retracted and always vibrating. The absence of a pharyngeal tube, or of a distinct peristome-field, is another character separating the genus from other Hypotricha.

Thurophora lucens, sp. nov. Plate IV., fig. 26, *a*, *b*, *c*, *d*.

Animalcules free-swimming, encuirassed, sub-elliptical when viewed dorsally or ventrally. Colour white, very translucent; cuirass indurated; cuticular surface distinctly striated; in side view elongate, narrow, truncate anteriorly, more or less pointed posteriorly; in end view from the anterior extremity convex above, deeply concave below, the edges incurved. Oral region occuying about three-fourths of the length, ventrally; elliptical, partly closed by a membranous, vibratile process, free on one side and apparently hinged all along the other. At the anterior extremity the oral region forms a very narrow groove, the sides of which are produced in two very short pointed processes bearing a bunch of short setæ; one of these processes is longer than the other. The membranous valve, or door, is very transparent and difficult to observe; but in the side and end views it may be seen projecting; it appears to bear on its edge some short cilia.

The body bears cilia throughout; but the dorsal cilia are very short, and seem to have no locomotive action; those of the ventral surface are longer and vibratile. The motion of the animalcules is very rapid, gliding, with occasional leaps.

Contractile vesicle single, central, appearing behind the oral membrane when the animalcule is viewed ventrally. Nucleus elongate, irregular, sub-central, rather nearer to the posterior end.

In several specimens observed a bundle of rather long, very fine cilia or setæ appeared at the posterior extremity, as shown in fig. 26, *a*. These were only to be made out in certain lights, and were not rendered conspicuous even by treatment with osmic acid, iodine, or other re-agents. As the animalcules exhibiting them presented no features distinctive from the others it was not thought advisable to make two species of them.

Length, $\frac{1}{400}$ inch = 62·5 μ; width, $\frac{1}{580}$ inch = 43·7 μ.

Masterton, Otaki, Kaitoki, *W. M. Maskell.*

This animalcule, which seems fairly common in the localities named, does not agree with any hitherto described. Its rapid motion and very translucent appearance render it extremely difficult to examine it properly. The membranous appendage, as mentioned above, differs essentially from that of the Holotrichous *Cyclidium* or *Pleuronema*.

Genus **Kerona**.

Kerona polyporum, Ehrenb. On *Hydra*, Waiwetu.

Genus **Opisthotricha.**

Opisthotricha parallela, Engelm, var. *minor*, var. nov. **Plate** IV., fig. 27.

Agrees with the European species in everything but its size, which is only $\frac{1}{360}$ inch $= 70\,\mu$. This dimension was constant in a great number of specimens examined.

Genus **Euplotes.**

Euplotes charon, Muller. Karori, Hutt Valley.

Class III. TENTACULIFERA.

Order. TENTACULIFERA-SUCTORIA.

Genus **Trichophrya.**

Trichophyra epistylidis, C. and L. (?) Hutt Valley.

The specimens examined appeared nearly identical with this species, but the tentacles could not be resolved into clearly separate fascicles, seeming rather to be irregularly scattered over the whole body. The animalcules were all on stems of various *Alga* : none were observed parasitic on *Epistylis.*

Genus **Acineta.**

Acineta flos, sp. nov. Plate IV., fig. 28.

Lorica cup-shaped, width nearly equal to the length, anterior margin deeply cut and produced in several fine points, which bend over slightly inwards ; pedicle very little more than half as long as the lorica, very slender. Animalcule sub-globular, a little dilated at the anterior edge, occupying only the upper portion of the lorica ; bearing numerous fine tentacles which protrude between the points of the lorica.

Length of lorica, exclusive of pedicle and points, $\frac{1}{260}$ inch $=$ $88{\cdot}8\,\mu$.

Wellington, *C. P. Powles.*

Allied to *A. mystacina*, Ehrenb., but very much smaller ; also the lorica is wider and rounder in proportion.

Acineta angularis, sp. nov. Plate IV., fig. 29.

Lorica trapezoidal, the sides below tapering sharply and straight down to the pedicle ; anterior edges angular, produced into two sharp points, which bend over leaving openings at the sides. Pedicle nearly as long as the lorica, tapering to a fine point at the base, wider above. Animalcule irregular, widest anteriorly, occupying only the upper part of the lorica and bearing two fascicles of capitate tentacles, which protrude through the side openings. Contractile vesicle posteriorly situated.

Length of lorica, exclusive of pedicle and points, somewhat variable, from $\frac{1}{350}$ inch = 71 μ, to $\frac{1}{290}$ inch = 88 μ; width at the lower angles $\frac{1}{440}$ inch = 58 μ.

Wellington, *W. M. Maskell.*

Allied to *A. mystacina*, Ehrenb., but the straight sides and sharp angles are constant and distinctive.

Acineta speciosa.

(*A. elegans*, nobis. "Trans. N.Z. Inst.," vol. xix., p. 60.)

A change in the name of this species is necessary, as our former one had been already appropriated by Imhoff ("Zool. Anzeig.," 1883) to an animalcule found in some of the Swiss lakes.

Acineta tulipa, sp. nov. Plate IV., fig. 30.

Lorica deep and narrow, not unlike a tulip-flower, the margin five-lobed, distinctly thickened but not recurved; breadth at the top nearly three-fourths the length; sides tapering rapidly and nearly straight to the posterior end, which is rounded. Pedicle very thick, rather short, nearly half the length of the lorica. Animalcule almost filling the lorica; anterior margin very convex. Tentacles arranged in two antero-lateral bundles, each containing nine. Parenchyma irregularly granular. Contractile vesicle spherical, situated near the anterior margin of the lorica, under one of its clefts.

Length of lorica, $\frac{1}{350}$ inch - 71 μ; length of pedicle, $\frac{1}{300}$ inch - 85 μ.

Wanganui, *T. W. Kirk.*

A distinct and rather elegant species.

Acineta lasanicola, sp. nov. Plate IV., fig. 31.

Lorica shallow, broad, sub-rectangular, having very much the shape of a stewpan; breadth nearly twice the depth; margin neither thickened nor recurved; sides almost parallel, lower angles very obtusely rounded; base slightly concave. Pedicle rather thick, more than twice as long as the depth of the lorica. Animalcule filling the margin of the lorica, but somewhat contracted below, so that it occupies only about three-fourths of the interior space; upper margin convex. Tentacles conspicuously capitate, arranged in two antero-lateral bundles, each containing eleven. Contractile vesicle spherical, sub-central. Endoplast band-like, posterior. Parenchyma granular.

Depth of lorica, $\frac{1}{470}$ inch = 54 μ; breadth, $\frac{1}{285}$ inch = 89 μ; length of pedicle, $\frac{1}{215}$ inch = 118 μ.

Wellington, *T. W. Kirk.*

A peculiar species, easily distinguished by the saucepan form of the lorica.

EXPLANATION OF PLATES I.–IV.

PLATE I.

Fig. 1. Monas claviculus × 700; *a*, extended; *b*, contracted form.
Fig. 2. Dendromonas producta; *a*, complete zoodendrium × 700; *b*, three animalcules and pedicles × 1000.
Fig. 3. Cephalothamnium coronatum × 700.
Fig. 4. Goniomonas elongata × 700, in various positions.
Fig. 5. Salpingœca inquillata, × 1000.
Fig. 6. Salpingœca steinii, *var.* (?) × 1000.
Fig. 7. Trachelomonas teres, × 600.
Fig. 8. Anisonema ovatum, × 800.
Fig. 9. Gymnodinium varians, × 700.
Fig. 10. Nassula ambigua, *var.* tumida, × 300.
Fig. 11. Chœnia crassa; *a*, extended animalcule × 100; *b*, oral aperture and canal, during inglutition of *Urocentrum turbo*, × 400.
Fig. 12. Amphileptus irregularis, × 350.

PLATE II.

Fig. 13. Amphileptus rotundus, × 350.
Fig 14. Amphileptus tracheloides, × 200, in different positions.
Fig. 15. Stentor attenuatus × 60; *a*, extended animalcules; *b*, *c*, free-swimming forms; at *d*, vibratile fringe denoting commencement of propagation by fission.

PLATE III.

Fig. 16. Tintinnidium fluviatile, *var.* emarginatum; *a*, animalcules in tubes × 350; *b*, animalcule × 700; *c*, free-swimming form × 350; *d*, end-view, free-swimming, × 700.
Fig. 17. Strombidium intermedium, × 700; *a*, normal animalcule; *b*, end-view of the same; *c*, propagation by fission, the new zooid at right angles to the old.
Fig. 18. Mesodinium phialinum, × 700; *a*, side-view; *b*, end-view.
Fig. 19. Zoothamnium limpidum; *a*, zoodendrium × 200; *b*, portion of stem and branches, showing the continuous muscular fibre, × 700.
Fig. 20. Cothurnia parallela, × 200.
Fig. 21. Cothurnia amphorella, × 350.
Fig. 22. Platycola decumbens, *var.* intermedia, × 200.
Fig. 23. Phascolodon elongatus, × 350.

PLATE IV.

Fig. 24. Ægyria astyla, × 350.
Fig. 25. Ægyria distyla, × 350.
Fig. 26. Thurophora lucens; *a*, animalcule, ventral aspect, × 350; *b*, oral region and membranous valve, × 700; *c*, side-view of animalcule, × 350; *d*, section, in end-view, × 350.
Fig. 27. Opisthotricha parallela, *var.* minor, × 350, dorsal aspect.
Fig. 28. Acineta flos, × 700.
Fig. 29. Acineta angularis, × 350.
Fig. 30. Acineta tulipa, × 350.
Fig. 31. Acineta lasanicola, × 350.

Art. II.—*On a Specimen of* Regaleous *recently Stranded in Otago Harbour.*

By T. Jeffery Parker, B.Sc., C.M.Z.S., Professor of Biology in the University of Otago.

[Read before the Otago Institute, 12th July, 1887.]

Plate V.

About four years ago I communicated to the Institute (7)* a description of a fine specimen of the Great Ribbon-Fish which had been cast ashore at Moeraki, and purchased for the Otago University Museum. The skeleton was prepared, and a detailed account of it published in a subsequent paper (8). After being for some time in the Museum, it was sent to the Colonial and Indian Exhibition of 1886 as part of a collection illustrating New Zealand zoology. This specimen, which is interesting as being apparently the first complete skeleton of *Regalecus* on record, is now in the British Museum (Natural History), South Kensington.

The fish which forms the subject of the present communication was cast ashore in Otago Harbour, about 1½ miles north of the village of Portobello, and 10 miles north of Dunedin, on the 3rd of June last. It was found by a settler, Mr. Harwood, who very generously presented it to the Museum, and even took the trouble to drive into Dunedin on purpose to inform me of the capture. But for his prompt action the fish would certainly have been considerably damaged before it could have been brought to the Museum, and might have been hopelessly ruined.

The specimen, which was 11 feet long, was specially interesting from the fact that the characteristic crest or nuchal fin was practically perfect, instead of being, as in the vast majority of examples which have come under the notice of naturalists, so damaged as to make its precise characters very doubtful.

As I was anxious to secure both a stuffed specimen and a skeleton, I had the skin removed, with the exception of that of the head, which was too thin to allow of its being separated from the underlying bone. A cast of the head was taken in plaster of Paris, and was attached to a wooden model of the body over which the skin was stretched, the whole being afterwards silvered and painted from tracings taken of the fresh fish. The fins were "made up," as the rays were required for the skeleton. In this way a specimen has been obtained which gives an excellent notion of the form, colour, markings, etc., of the fish, and in addition an almost perfect skeleton.

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* The figures in thick type refer to the bibliographical list at the end of the paper.

Since the account of the Moeraki specimen was published, I have been favoured by the authors, Dr. Chr. Lütken, of Copenhagen, and Dr. Robert Collett, of Christiania, with copies of three important papers on northern species of *Regalecus*. Lütken's second paper (6), which is a *résumé* of his first (5), is accompanied by a French translation, and is also translated into English, in the "Annals and Magazine of Natural History" for 1883. Collett's paper (1) is in Norwegian; and I should have been able to make out little beyond the description of the plates but for the kindness of Mr. C. Theilmann, who was good enough to translate both it and the necessary portions of Lütken's first paper for me.

It is perhaps not unworthy of mention that the majority of specimens found in the Northern Hemisphere have been obtained in winter or early spring. Out of 25 examples recorded by Collett (1) as having been obtained either in Scandinavia or in Great Britain during the past century, 8 were found in March, 4 in February, 3 in January, and 3 in April. Of 6 New Zealand specimens, of which the date of capture is recorded, 3 were found in winter (2 in June and 1 in July), 1 in late autumn (May), and 1 in early spring (October).* These facts are not without interest as bearing upon the case of another deep-sea Teleost, the Frost-fish (*Lepidopus caudatus*), which is hardly ever obtained except by being found stranded on sea-beaches during the winter. It is also remarkable that all the *Regaleci* the sex of which has been ascertained have been females.

It will be convenient to discuss the present specimen under the following heads :—

(*a*.) Size, proportions, and number of fin-rays.
(*b*.) Evidence of mutilation of tail.
(*c*.) Colour and markings.
(*d*.) Characters of the crest or nuchal fin.
(*e*.) The skeleton.

(*a*.) *Size, proportions, and number of fin-rays.*—The chief facts under this head are best given in the form of a table, which will serve to show at a glance the main differences between the three New Zealand specimens of *Regalecus* which have been carefully examined—viz., von Haast's New Brighton specimen, and the two which have come under my notice :—

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* In mentioning the recorded occurrences of *Regalecus* in New Zealand in my former paper (7), I omitted two : A specimen 14 feet long is mentioned by Mr. F. E. Clarke ("Trans. N.Z. Inst.," vol. xiii., p. 196) as having been found near Jackson's Bay by Mr. James Teer, in February, 1874; and Sir James Hector records the capture of a "species of Banks' Oar-fish, *Regalecus gladius*" [*sic*] at Cape Farewell Sandspit ("Trans. N.Z. Inst.," vol. x., p. 588). The date of capture of this last example is not given : it seems to have been shortly before December, 1877.

——	New Brighton, 1876.			Moeraki, 1883.			Otago Harbour, 1887.		
	Ft.	in.	Centim	Ft.	in.	Centim	Ft.	in.	Centim
Total length	12	5	378·75	12	6	381·25	11	0	335·5
Greatest height of body ..	1	1·75	35·0	1	3·25	38·7	1	0	30·5
Length of head (jaws retracted)	0	7·75	19·5	0	9	22·8	0	9·5	24·0
Distance between snout and anus	4	11	150·0	5	6	167·75	4	9·5	146·0
Proportion of height to length	1 : 11			1 : 10			1 : 11		
Proportion of length of head to total length ..	1 : 19			1 : 17			1 : 14		
Proportion of pre-anal region (= head + trunk) to total length	1 : 2·5			1 : 2·27			1 : 2.29		
Total number of dorsal fin-rays	232 (9 + 223)			205 (14 + 191)			189 (14 + 175)		

It will be seen that the only differences of importance between the three specimens are those connected with (*a*) the size of the head, which is shortest in the New Brighton, longest in the Otago Harbour specimen; and (*b*) the number of fin-rays, which are most numerous in the New Brighton, fewest in the Otago Harbour specimen.

Similar differences exist between the examples found in the Northern Hemisphere. In eight of these, tabulated by Lütken (5, p. 26), the proportion between the greatest height of the body and the total length varies from 1 : 9 to 1 : 15 ; the proportion between the length of the head and the total length, from 1 : 14 to 1 : 21 ; the proportion between the pre-anal region and the total length, from 1 : 1·7 to 1 : 3·2 ; and the number of dorsal fin-rays from 174 to 406.

(*b.*) *Evidence of mutilation of tail.*—The tail (Pl. V., fig. 4) had evidently been broken off obliquely, probably at no very distant period, since the broken surface of the last vertebra was visible externally.

The fracture had taken place across the middle of the 89th vertebra, the remaining or anterior half of which agreed in every respect with the corresponding portion of the preceding vertebræ, and was quite different from the peculiar *demi-vertebra* which terminated the vertebral column of the Moeraki specimen (3, Pl. VI., figs. 25 and 26). It is, of course, possible that in the process of healing the broken bone might assume the form of the demi-vertebra, but the differences between the two make me disposed to doubt it. As to the form of the tail itself, it is truncated obliquely, not bluntly-pointed with a ventral emargination, as in my first specimen and in von Haast's.

All the specimens examined by Collett had the tail broken in a very similar way, the last vertebra showing a fresh-fractured surface. Collett considers that the missing piece of the tail is usually of small size, his conclusion being founded upon the fairly constant position of the anus, which is, as a rule, a little cephalad of the middle of the body. He states that the usual proportion is for the pre-anal region, or head and trunk, to be $\frac{4}{10}$ths, the post-anal portion, or tail, $\frac{6}{10}$ths of the total length; or, in other words, that the proportion between the length of the pre-anal region and the total length is 1 : 2·5. It will be seen that, in this respect, the resemblance between the Northern and Southern *Regaleci* is very close.

Lutken considers that the end of the tail, with the tail-fin, is lost at an early age, and that regeneration then takes place, producing an additional piece of varying length. In this way he accounts for the great length (18 feet, or 564 centim.) and unusual number (406) of fin-rays of Lindroth's Hitteren specimen (*R. grillii*). He also remarks upon the fact that the examples recorded from the Mediterranean have all had uninjured tails, with small tail-fins, as shown in Cuvier's figure of *R. gladius* (2).

(*c.*) *Colour and markings.*—The general colour was, as in former specimens, that of pure frosted silver. The irregular sub-vertical black stripes and spots in the anterior half of the body were also of the usual character, but more distinct than in the Moeraki specimen when quite fresh (see 7, p. 298). But in addition to these the whole body was covered with oval or circular dull grey spots, formed of aggregations of chromatophores, covered and thus toned down by a thin silvery coating. These spots were from 1·5 to 0·5 inch (4—1·5 cm.) in diameter: those along a line equidistant from dorsal and ventral edges were longitudinally oval, the rest circular; each was slightly lighter in tint in the centre than at the circumference. Von Haast mentions them as "dark rings" (3, p. 248), but there is no indication of them in his figure. Their appearance was precisely that shown in Cuvier's figure of *R. gladius* (2, Pl. 69), in which, however, the anterior black bars are absent. A thoroughly good notion of the appearance of the present specimen would be obtained by painting on the anterior half of Cuvier's figure the black bands shown in Hancock and Embleton's drawing of *R. banksii* (4), or in von Haast's of *R. pacificus* (3). The distinction in the fresh fish between the very obscure spots, hardly visible in certain lights, and the intensely black bands on the front half of the body was very striking.

According to Collett, the body in the Northern forms is also marked with 4–6 brownish black longitudinal bands. I am disposed to think he must refer to the elevated longitudinal ridges present in most of the accurately described specimens. There was no special development of pigment on them in either of my examples, but they would assume the appearance of dark bands in a dried specimen.

As in the Moeraki specimen, the raised tubercles with which the body is beset are composed of thick fibrous tissue. This was made very obvious when the skin was allowed to dry; instead of standing out even more prominently than in life, as they would have done if made of bone, they almost disappeared, and are barely visible in a thoroughly dried piece of skin.

(*d.*) *Characters of the crest.*—The precise characters of the crest, nuchal fin, or first dorsal fin of *Regalecus*, seem always to have been doubtful. In my former paper (7) I gave a *résumé* of all previous descriptions which had come under my notice, as well as outline sketches of the more important published figures, of which it will be seen no two are alike. Lütken gives a figure of a specimen found at the Faröe Islands (5, p. 20), in which the crest is shown to consist of two distinct nuchal fins, the anterior rather less, the posterior a little more than thrice the height of the head, and the rays of both terminating in simple points. Collett (1, Pl. II.) figures the crests of two specimens, one from Nordfjord, the other from Stavanger; in both, the rays are broken off short, and the membrane between them is lost. These are the only additional figures I have met with since the publication of my former paper. In the present specimen, as already stated, the crest was nearly perfect, the only broken rays being the seventh and ninth. The membrane of the fin was very little damaged, and by floating the whole crest out in a dish of water, its characters could be perfectly well ascertained.

I find that in all essential respects the crest of the Otago Harbour specimen (fig. 1) agrees with that of Cuvier's figure of *R. gladius** in the illustrated edition of the "Règne Animal." It is distinctly divisible into two portions or "nuchal fins," an anterior consisting of five, and a posterior of nine rays; so that the total number of rays in the crest is fourteen. In my former paper I gave the number conjecturally as fifteen, stating that what I took to be the last six rays were broken; judging from the present specimen, it must have been the last five rays of the crest and the first of the second dorsal which were damaged. Cuvier's figure shows five rays in the anterior, seven in the posterior division.

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* Reproduced in 7, plate xxiv.

The length of the rays is as follows :—

Crest, or "First Dorsal."

		In	Cm.	Condition
First Nuchal	Ray I.	22	56	Perfect.
	,, II.	20·5	52	,,
	,, III.	18	46	,,
	,, IV.	14·5	37	,,
	,, V.	13	33	,,
Second Nuchal	,, VI.	29·5	75	,,
	,, VII.	21	53	Distal end wanting.
	,, VIII.	20	51	Perfect.
	,, IX.	1	2·5	Broken off short.
	,, X.	12·5	32	Perfect.
	,, XI.	9	23	,,
	,, XII.	7·1	18	,,
	,, XIII.	3·2	8	,,
	,, XIV.	1·4	3·5	,,

"Second Dorsal."

	In	Cm.	Condition
Ray XV.	1·4	3·5	,,

As in most other carefully-described specimens, including the two figured by Collett, the first ray is stout at its proximal end (4 mm. in diameter), the next four—*i.e.*, the remaining rays of the first nuchal—extremely slender (about 1·75 mm.), and those of the second nuchal stout, their thickness diminishing, however, *pari passu* with their length, so that the last is of the same thickness as the rays of the second dorsal. The reason of this variation in thickness is apparent, when it is seen, as described in the following paragraphs, that the rays of the first nuchal are united to one another for about their proximal half by membrane, while those of the second nuchal are free, except at the base.

The first ray is united by membrane to the second for at least its proximal 34 cm., probably a little more—its distal portion being fringed by a delicate wavy membrane, which terminates in a simple point, and is continued into a very narrow band, edging the anterior face of the distal end of the ray (fig. 2). The four following rays are similarly joined, the vertical height of the uniting membrane diminishing progressively in successive interspaces, from 34 cm., between the 1st and 2nd rays, to 21 cm. between the 4th and 5th.

The remaining rays—those of the second nuchal—are united only at the base: how far is uncertain, the membrane being torn, but probably between 2 and 4 cm. These rays are all fringed posteriorly by a wavy membrane, which terminates distally in a thickened lanceolate lobe (fig. 3), as described in my former papers. These lobes were present on all the rays of the second nuchal, except the 7th and 9th, the former of which was damaged at the tip only, the latter broken off short. Curiously enough, the 7th and 9th were the only two perfect rays in the Moeraki specimen. The presence of a small but distinct lobe (about 8 mm. long) on the 14th ray, and the absence of anything of the kind on the 15th, allows of a clear distinction being drawn between the crest or "first dorsal" fin and the "second dorsal," although the adjacent rays being united by membrane, there is, strictly, only one continuous fin.

A comparison of Pl. V., fig. 1, with Cuvier's figure (7, plate xxiv., fig. 6) shows that the only difference of importance between the two is that the second nuchal in the latter has seven rays instead of nine, and that the terminal lobes are represented as much larger than in my specimen.

In the first nuchal the pink membrane uniting the rays was marked with small circular spots of a deep crimson colour, (about 2–3 mm. in diameter,) and arranged in a single row in each membranous interspace. Examined microscopically, these were found to be produced by aggregations of well-marked sub-circular chromatophores, having interspersed among them branched black pigment-cells.

In the second nuchal each ray with its membrane was marked with nearly equidistant crimson blotches, about 8 mm. in diameter, generally occurring in the wider parts of the wavy membrane. These also contained both red and black chromatophores; the former faded considerably after two or three days, the spots then appearing of a dull grey colour.

These large patches of red are shown in Cuvier's figure; but the small spots of the first nuchal are not indicated either in that or in any other figure with which I am acquainted.

All the descriptions and figures of the crest of *Regalecus* with which I am acquainted can be accounted for on the theory that it had, when uninjured, the characters described above, with the single exception of von Haast's. He states (3, p. 248) that, in *R. pacificus*, the 2nd and 7th rays were perfect, and were respectively 7 and 7·75 inches long; he also says that the 3rd, 4th, and 5th rays were nearly as thick as the first, and that all were beset with minute upwardly-directed hooks on the anterior and posterior edges.

(*e.*) *The skeleton.*—This agrees in all essential respects with that of the Moeraki specimen, the only important difference being in the number and position of the ribs. In the Moeraki specimen there were ribs on the 8th–25th vertebræ inclusive, and in Lütken's Faröe Islands specimen (5 and 6) on the 8th–24th. In the present skeleton the 6th vertebra has a rib on the right side only; from the 7th to the 20th there are well-developed ribs, and rudiments on the 21st–23rd.

Both pelvic (= ventral) rays were broken off short, but attached to one of them by a shred of membrane there was, as I am informed by my assistant, Mr. Jennings, a bony rod about 6 inches long, of the same thickness as a pelvic ray, curved at its proximal end, and fringed with membrane. The fact of the bone not being straight is peculiar, and its thicker or proximal end did not correspond with the broken attached end of the pelvic ray. Jennings assures me, however, that he removed it from its attachment himself; moreover, it is obviously a *Regalecus* bone, and agrees in appearance, size, etc., with nothing but the pelvic rays, so that its curvature is probably teratological.

The Otago Harbour specimen of *Regalecus* is obviously of the same species as that from Moeraki, the only difference of importance being the faint spots of the former. Whether these are a matter of age it is impossible to say, but apparently not, as both individuals were adult or sub-adult females. I therefore assign the present specimen to the species *R. argenteus*, Parker, the diagnosis of which (see 7, p. 295) must be amended in the following particulars :—

(1.) The number of dorsal rays and the proportion of height of body and length of head to total length are variable, the caudal extremity being subject to mutilation.

(2.) The first *fourteen* rays of the dorsal fin form a crest about three times as high as the head, and divided into an anterior portion of five, and a posterior of nine rays : the former have their lower halves connected, their upper halves fringed posteriorly by membrane, and terminate in simple points ; the latter are connected only at the base, fringed posteriorly, and terminate in small lanceolate cutaneous lobes.*

(3.) The body is silvery, marked on its anterior half with irregular sub-vertical stripes and spots, and having sometimes, in addition, faint grey spots over the whole surface.

It appears very probable that further researches on this interesting genus will necessitate the union of more or fewer of the species, but the information is at present insufficient to decide the question. As Lütken remarks, "il est clair que le genre est assez cosmopolite, mais on ne peut rien dire encore quant au nombre de ses espèces."

BIBLIOGRAPHY.

1. R. Collett.—"Om de i vort Aarhundrede ved de norske Kyster strandede exemplarer af Slægten *Regalecus*." "Christiania Videnskabsselskabs Forhandlinger," 1883, No. 16
2. Cuvier.—"Règne Animal, Poissons," p. 148, and pl. 69.
3. v. Haast.—"Notes on *Regalecus pacificus*, a new Species of Ribbonfish from the New Zealand Seas." "Trans. N.Z. Inst.," vol. x. (1876), p. 246.

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* In the specific description referred to (7, p. 295) the words occur: "*three or four* of them [the rays of the crest] terminate in lanceolate cutaneous lobes :" the words in italics were substituted by a printer's error for "*more or fewer*."

4. Hancock and Embleton.—"Account of a Ribbon-fish (*Gymnetrus*) taken off the Coast of Northumberland." "Ann. and Mag. Nat. Hist.," *2nd series, vol. iv., 1849, p. 1.*

5. Lütken. — "*Trachypterus arcticus og Gymnetrus banksii (grillii).*" "*Vidensk. Meddel. fra den naturh. Foren. i Kjobenhavn,*" *1881, p. 190.*

6. Lütken.—"Nogle Bemærkninger om Vaagmæren (*Trachypterus arcticus*) og Sildetusten (*Gymnetrus banksii*):" with French translation. Oversigt over d. k. D. Vidensk. Selsk. Forhandl., 1882, p. 206. Translation by W. S. Dallas in "Ann. and Mag Nat. Hist," 5th series, vol. ii., 1883, p. 176.

7. T. J. Parker.—"On a Specimen of the Great Ribbon-fish (*Regalecus argenteus*, n. sp.) lately obtained at Moeraki, Otago." "Trans. N.Z. Inst.," vol. xvi. (1883), p. 284 *

8. T. J. Parker.—"On the Skeleton of *Regalecus argenteus.*" "Trans. Zool. Soc.," vol. xii., part 1 (1886), p. 6.

Postscript.—Since writing the above I have seen Professor McCoy's description of a Ribbon-fish caught in the waters between the Victorian and Tasmanian coasts, in May, 1878. The description occurs in the 15th decade of the "Prodromus of the Zoology of Victoria," and is illustrated by a coloured plate. The specimen is especially interesting from the condition of the tail, which tapered gradually to a vertical height of 1 cm., when it was broken off: thus, even if it tapered, when perfect, to a veritable point, it cannot well have lost more than 3 or 4 cm. In correspondence with this, we have the important fact that the number of dorsal fin-rays is 17 + 406, that is exactly the same as in Lindroth's Hitteren specimen (*R. grillii*), in which the number of rays is given as 406, the nuchal rays being, according to Collett, counted separately.

Unfortunately, McCoy does not give the position of the anus: the remaining chief measurements are as follows:—

	ft.	in.	cm.
Total length	13	7	424
Length of head	0	7·5	19
Greatest height of body	0	7·25	18·5

Proportion of length of head to total length .. 1 : 22
„ „ height of body „ „ .. 1 : 23

From the analogy of this specimen one would conclude that the Otago Harbour *Regalecus* described above must have lost at least 6 feet (180 cm.) of its length, or, in other words, that in the uninjured condition it must have been fully 17 feet (528 cm.) long.

The markings of McCoy's specimen, as shown in the plate, are peculiar. The black bands on the anterior part of the body are more nearly vertical, and more irregular in form and size, than usual; the oval or circular spots do not extend over the

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* Further references to the literature of the subject are given in this paper.

anterior part of the body, and are quite black; and five longitudinal black stripes are shown, which, however, seem to be intended for the grooves between the elevated ridges.

No detailed description of the crest is given—the figure shows a single nuchal fin, the rays terminating in simple points and regularly diminishing in length from before backwards.—T.J.P.

Dunedin, January 6th, 1888.

Art. III.—*Ornithological Notes.*

By T. W. Kirk (of the Geological Survey Department).

[*Read before the Wellington Philosophical Society, 6th July,* 1887.]

1. Petrœca toitoi, *Less.*—Pied Tit (*Miromiro*).

I was recently shown a most beautiful example of this species, exhibiting pure albino plumage; it is in the private museum of Mr. S. H. Drew, of Wanganui; the only indication of the normal colouring is a small patch on one of the primaries, and that is only faint grey.

As the unfortunate victim was killed with a full charge of powder and an ounce of No. 4 shot, the internal anatomy was so much knocked about that Mr. Drew was unable to ascertain the sex. He has, however, by careful skinning and mounting succeeded in transforming the battered skin into a really good museum specimen, a result of which, as an amateur taxidermist, he may well be proud. This is, I believe, the first notice of albinism in the Pied Tit.

The specimen was procured at Paraekaretu, in the Rangitikei District, by Mr. Tripe.

2. Anthus novæ-zealandiæ, *Gml.*—Ground Lark (*Pihoihoi*).

Varieties inclining to albinism are known to occur occasionally; but while travelling through the bush on the east coast of this provincial district, I came on a Maori plantation, and was shown by one of the Natives a Ground Lark exhibiting a tendency both to albinism and melanism. The following is a description jotted down in my pocket-book:—Top of the head, and down as far as a line through the centre of the eye, were a dull black; the whole of the body and wings, with the exception of the two outer primaries, a delicate creamy white; the outer primaries of the normal greyish-brown. The outside tail-feathers, which in an ordinary specimen would be white, were in this case jet black.

This bird, which was one of the most curious freaks I ever saw, had been tamed, and would come when called and allow itself to be picked up and examined, as though conscious of deserving attention on account of its peculiar adornments.

I endeavoured to effect a purchase, but without success, the Maoris appearing to set great store by their pet.

3. Phalacrocorax punctatus, *Sparrm.*—Spotted Shag.

Writing of this species Dr. Buller says:—"This beautiful representative of the crested shag is abundant on the coast of the South Island, but it is seldom met with on the Northern side of Cook Strait. I observed a party of three at the mouth of the Waikanae River, in January, 1864; two young birds were killed in Wellington in the winter of 1865; and another was shot in the Gulf of Hauraki, near Auckland; and these are the only instances I know of its occurrence in the North Island. . . . I have never had an opportunity of examining the eggs; but I understand that *three* is the usual number." ("Manual of N.Z. Birds," p. 95.) It will therefore be interesting to note that I was lately informed by Mr. J. C. McLean that a colony of fifteen or sixteen of these birds has, for more than five years, been established on a reef inside Cape Kidnappers. He states that he has collected the eggs, but never found more than *two* in a nest. In December, 1885, there were five nests, placed at equal distances apart along the ledge which runs on one side of the rock, about 8 feet from the top. They were composed of sea-weed, and were but a little larger than the nests of the Mackerel Gull (*Larus scopulinus*, Forst.) One nest had *two* eggs in, and each of three others contained *two* young birds covered with black down, the fifth being empty. On the other side of the rock, out of reach, was another nest; this also contained but *two* eggs. On visiting the locality again last December, the nests were found to be more numerous, but apparently the season was much later, as there were neither eggs nor young birds visible, but the old ones were grouped about, and allowed him to approach quite close before they took wing; their breeding-place being very difficult of access, it is evident they are not often disturbed. The egg is smaller than that of the Black Shag (*P. novæ-hollandiæ*, Gould) and very dirty. The original colour pale blue.

Mr. McLean has kindly promised to furnish me with the measurements of the eggs in his possession.

The Cape is also the breeding ground of a large number of Gannets (*Dysporus serrator*).

4. Sterna antarctica, *Forst.*—Common Tern (*Tara*).

The local name of this bird in the neighbourhood of Cape Kidnappers is "The Plough Bird," or "Plough Boy," given on account of its habit of closely following the plough for the purpose of obtaining the grubs, &c., thus exposed.

5. **Nestor meridionalis**, *Gml.*—Brown Parrot (*Kaka*).

The author of the "History of the Birds of New Zealand" has described several varieties of this bird; one gorgeously-coloured specimen he mistook for a distinct species, and differentiated it under the title of *N. superbus*. Further examination, however, convinced him that it was only a variety of the Kaka, and he accordingly sank the specific name. In 1884 I recorded the capture of an almost identical specimen at Waikanae—and now another, hardly to be distinguished, is to be seen on view in the shop of Mr. Liardet, taxidermist. I am informed that this latest addition to the long list of New Zealand birds presenting abnormal colouring was shot in the Kaikoura Mountains.

Art. IV.—*On a curious Parasite* (Anthosoma smithii, *Leach*) *from the Porbeagle Shark* (Lamna cornubica).

By T. W. Kirk (of the Geological Survey Department).

[*Read before the Wellington Philosophical Society, 6th July*, 1887.]

Plate VI.

The genus *Anthosoma* was created by Leach for the reception of a most curious crustacean, specimens of which were found adhering to the gill-covers of the Porbeagle Shark (*Lamna cornubica*), that had been thrown ashore at Exmouth, in Devonshire. The species was named after Mr. T. Smith, the discoverer, who sent it to the British Museum, and it has remained the sole representative of the genus and family.* I am not aware of any record of the occurrence of this creature in Australian waters. Some weeks ago, however, a fine Porbeagle Shark was captured by fishermen belonging to this port, and exhibited by them for some days; it was then procured for the Museum. During the operation of skinning, the taxidermist noticed and procured the specimens now exhibited.

Although differing in minor details from Leach's description and figure, I have little hesitation in referring it to his species, especially as it was obtained from the same host.

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* The description and figure were first published by Leach in the "Encyclopædia Britannica" of 1816.

CLASS CRUSTACEA.

Order COPEPODA.

Genus **Anthosoma.**

The head is of tolerable size, and distinct, consisting of a stout, rather narrow and strongly convex, horny buckler, of an ovoid shape. It is very narrow, thick, and obtuse in front, where it has a furrow running across its dorsal surface, and a deep notch on each side, which thus forms a beak, and almost divides it into a separate segment. It extends backward for some length, and becomes considerably broader, covering a portion of the thorax.

The segments of the thorax are very indistinct. On the dorsal aspect are two foliaceous elytraform appendages of an oval shape, and of a light horny and granulated texture. Beneath these the remaining portion of the thorax is seen, of a fleshy structure, and apparently without divisions.

The abdomen is very small, consisting of one short segment, which gives off two small caudal appendages in the form of short, flat, blunt filaments of the same texture as the elytraform appendages. Immediately beneath the notch, on each side of the blunt peak, we see a small flat body, and from near the base of each of these we find the origin of the antennæ. These organs are rather long and slender, and consist of six articulations, tapering from the base to the extremity. The most remarkable organs attached to the head, however, are the first pair of foot-jaws. These arise from between the base of the antennæ, are very long and strong, and project forward beyond the head. They consist of three stout joints of considerable length, and of cylindrical shape; the second joint, near its apex, having a tooth or spine, the last being terminated by a curved hook, which points upwards and backwards. The second, of three joints also, is of nearly equal length, but much more slender, and has the terminal joint ovate, compressed, and bifid. The third pair is short, very thick, stout, of two joints, and terminates in a strong claw-shaped extremity. The feet are three pairs, and are all foliaceous. The structure of these members is very simple, being merely foliaceous lamellæ, which lap over each other and surround the thorax as with a shield. They are of a light horny texture and somewhat granulated, like the dorsal elytraform appendages. The oviferous tubes are straight and very long. (Baird, "Brit. Ent.," p. 298.)

The form of the feet and structure of the foot-jaws indicate that this animal is capable of little motion, and lives a strictly parasitic existence. It buries its beak in the flesh of its host, and thereby causes him much irritation, as evidenced by the inflamed appearance of the parts attacked.

ANTHOSOMA SMITHII (Leach).

("Encyc. Brit.," i. 406. t. 20. f. 1-6.)

"Animal of an elongated oval form, about ten lines in length, and of a ferruginous white colour, bordering upon yellow. When alive it has a black spot upon the middle of the head, which disappears after death. The dorsal elytraform appendages and foliaceous feet are sprinkled over with semi-transparent spots." (Baird.)

The New Zealand specimens differ in size, the length of the body being six lines, and the oviferous tubes one inch in length. When alive, the buckler and oviferous tubes were a rich brown. The dorsal appendages and foliaceous feet were white. The feet were much swollen, and, in some instances, presented an almost globose outline.

DESCRIPTION OF PLATE VI.

Fig. A. Adult animal, enlarged.
Fig. B. Third foot from right side, enlarged.

ART. V.—*On the Occurrence of the Masked Plover* (Lobivanellus personatus, *Gould*) *in New Zealand.*

By T. W. KIRK.

[*Read before the Wellington Philosophical Society, 6th July*, 1887.]

SEVERAL instances are mentioned in the "Transactions of the New Zealand Institute" of the discovery of Australian birds on the coasts of these islands, viz.:—

(1.) The Australian Tree Swallow (*Hirundo nigricans*, (Vieill).*
(2.) The Royal Spoonbill (*Platalea regia*, Gould). By Dr. Buller.†
(3.) The Australian Roller or Dollar-Bird (*Eurystomus pacificus*, Lath.). By Mr. F. E. Clarke.‡
(4.) The Red-Capped Dotterel (*Charadrius ruficapillus*, Temm.). By T. W. Kirk.§

The species now to be noticed is more beautiful than any of our previous visitants. The Masked Plover is one of the spurwings, and stands about 12 inches high. The body is slight, very elegantly proportioned, and the general appearance is extremely graceful. It is thus described in Gould's "Handbook to the Birds of Australia:"—"Crown of the head and occiput jet-black; sides of the face, back of the neck, rump, and all the under-surface pure white; back and scapularies light brownish-grey; wing-coverts grey; primaries deep-black; secondaries white at the base on their inner webs, cinnamon-grey on their outer webs, and largely tipped with black; tail white at the base, broadly tipped with black, the extreme ends of the feathers being cinnamon-grey, particularly the two centre ones; irides primrose-yellow; wattles lemon-yellow; bill lemon-yellow at base, black at the tip; legs and feet carmine-red; the scales in front blackish-green."

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* "Trans. N.Z. Inst.," vol. xi., p. 360.
† Ibid., vol. ix., p. 337.
‡ Ibid., vol. xiii., p. 454.
§ Ibid., vol. xii., p. 246.

The bird was observed in a field at Kai Iwi by Mr. G. Penke, who at once went to the house for a gun; taking a long shot he fired, and the bird dropped, but when secured appeared quite unhurt, and lived for some time in confinement. Refusing food almost entirely, it died after a short captivity. It was mounted, and is now in Mr. S. H. Drew's Museum at Wanganui.

Both sexes possess the spur on the wing, which is a very noticeable feature; but it is much more developed in the male than the female, and proves a very effective weapon in warfare. The yellow-coloured mask is supposed to be for the protection of the feathers, the bird being very fond of thrusting its beak into mud and sand in search of small crustacea, or the larvæ of *Coleoptera*, which form the staple of its food.

Art. VI.—*Brief Description of a new Species of large Decapod* (Architeuthis longimanus).

By T. W. Kirk.

[*Read before the Wellington Philosophical Society, 30th November,* 1887.]

Plates VII., VIII., IX.

It may be remembered that in 1879 I brought under the notice of this Society all the particulars obtainable regarding four gigantic Calamaries, stranded on various parts of the New Zealand coast, together with a detailed account of a very large specimen which was cast ashore at Lyall Bay, Cook Strait, and which I was able to sketch and measure carefully. The beak and pen, or internal skeleton, of this specimen are preserved in the Museum. In June, 1880, rather more than two years after the first specimen was cast ashore at Lyall Bay, another, but of an entirely distinct species, was reported to be lying on the beach at Island Bay. In the last volume of "Transactions" Mr. C. H. Robson mentions that yet another, differing in many points from both the Wellington specimens, was found amongst the rocks at Cape Campbell. And now we have another of these highly interesting, but very objectionable, visitors. Early last month Mr. Smith, a local fisherman, brought to the Museum the beak and buccal-mass of a cuttle which had that morning been found lying on the "Big Beach" (Lyall Bay), and he assured us that the creature measured sixty-two feet in total length. I that afternoon proceeded to the spot and made a careful examination, took notes, measurements, and also obtained a sketch, which, although the terribly heavy rain and driving southerly wind rendered it impossible to do justice to the subject, will, I trust, convey to you some idea of the general outline of this most recently-arrived Devil-fish.

Measurements showed that, although Mr. Smith was over the mark in giving the total length as 62 feet (probably, not having a measure with him, he only stepped the distance), those figures were not so very far out; for, although the body was in all ways smaller than any of the hitherto-described New Zealand species, the enormous development of the very slight tentacular arms brought the total length up to 55 feet 2 inches, or more than half as long again as the largest species yet recorded from these seas.

The length of the tentacular arms is not a very important character, as they are known to be capable of extension or retraction at the will of the animal, at least to a considerable extent.

The fact that these monsters are only stranded in the winter, and their comparative frequency during that season, appears to show that they venture nearer shore at that time of the year, probably in order to feed on the shore fishes, and being caught by a gale are stranded, when not dead, in such an exhausted condition as to be almost powerless. Indeed I am inclined to think, that were they thrown ashore in robust health, they could not reach the water. My reason for saying so, is that I have tried experiments with specimens of the smaller Cephalopods caught in fishermen's nets, and have invariably found that whilst the true octopus will fight fiercely, he will steadily make for his native element, and has little difficulty in travelling on land; whilst the squid or decapod, although occasionally showing fight on land, appears unable to drag its long body over the ground, and therefore, if the tide is receding, it is sure to die before the next rise.

This specimen was a female, and to this fact may be due some of the points in which it differs from previous occurrences; but yet they are so considerable that I have no doubt a new subgenus at least will have to be created for its reception. In the meantime I place it under *Architeuthis*, with the full knowledge, however, that it cannot possibly remain there permanently, the shape of the arms and the fins alone being sufficient to put it out of association with that genus. As soon as opportunity offers, I hope to make a further study and fully determine its affinities.

ARCHITEUTHIS LONGIMANUS.

Sessile arms unequal in size and length, increasing from the dorsal to the ventral. First pair (dorsal) shorter than the body, triangular in section, with a stout fleshy membrane on each of the inner angles, the inner one slightly longer than the outer; this membrane can be folded over the suckers. Second pair (sub-dorsal), longer and stouter than the last, but not equal to the length of the body; rectangular in section, the sides and angles being, however, somewhat rounded, with thick fleshy membrane on each of the inner angles; these membranes are of equal width and strength. A thick crest runs along the outer face of these arms; it rises nearer the upper than the lower angle, and occupies about three-fourths of the face; its depth is nearly the diameter of the arm. Third pair (sub-ventral) still larger in all respects, and rather longer than the body; oval in section, the inner or sucker-face being flattened, each angle furnished as in the preceding arms with a fleshy membrane, the outer being slightly more developed than the other. Fourth pair (ventral) very long and exceptionally stout, rather longer than the head and body together; trapezoidal in section; stout fleshy membranes on the inner angles, the outer one the longest. A very stout fleshy crest on the lower posterior angle, and a much longer but slighter on the upper posterior angle.

The arrangement of the suckers on the sessile arms is very remarkable. The first (dorsal) pair carried fifty-four suckers on each arm, disposed as usual in two alternating rows; but these suckers were all small. The second had only forty-seven suckers, but these were very much larger than those on the first pair. The third had eighty-six, about the same size or a little smaller than those on the last pair. The fourth carried one hundred and forty-four, all about the same size as those on the second pair. As in the case of all animals belonging to this section, each sucker was stalked, the stalk being inserted on the side; each sucker is strengthened by a bony ring having a number of sharp teeth on the exposed edge. These bony rings are quite white when first taken from a fresh specimen; but after being in spirit for some time they assume a yellowish horn colour. They are all oblique (see figures).

Tentacular arms are very long and slender, more than six times the length of the fourth (ventral) pair of sessile arms, or of the head and body together. The arm is nearly round, and of equal diameter throughout. The clavate portion is triangular, with a membrane on the posterior angle. A large and irregular cluster of small suckers and tubercles at the base of the club; this cluster gradually thins out and extends up the arm, the distance between the individual suckers increasing till they are about twenty inches apart; they then occur at regular intervals, a pair, sucker and tubercle, all up the arms. The larger suckers on the club are arranged in two alternating rows, with smaller intermediate marginal ones on each side.

The head is long, and of equal circumference, save a little behind the centre of the eye, where the cephalic cartilage causes a distinct prominence. The eye is prominent, with a well developed lid and anterior sinus.

The body is somewhat contracted a short distance behind the anterior margin, then it increases in circumference to the centre, whence it tapers to the tail.

The fins (Plate VIII., fig. 1) are broad rhomboidal, the posterior extremity produced into a blunt, but well developed, "tail;" the anterior lateral margins somewhat concave, and produced beyond the insertion, but the produced portion rounded.

The jaws (Plate IX., fig. 1, 2), when in position, as shown in Plate IX., fig. 3, form a powerful beak, resembling that of some gigantic bird of prey, except that the order is reversed, and in this instance the upper jaw fits into the lower, not lower into upper as is the case with birds. The tips of the jaws are black, which gradually passes into dark brown, and this again into a much lighter shade till the margin is reached, where the brown has quite disappeared and a border of dirty white remains. The palatine lamina is dark brown, becoming lighter toward the margins, which are white. The rostrum is strong, convex, acute, and curved forward, the cutting edges being concave, not, or but very slightly, notched at the base. The anterior edges of the alæ are uneven, being toothed or chipped all along. The lower mandible is very stout, not so much curved, no notch near the tip, which is acute; cutting edge straight, with deep notches at the base; succeeding this notch, and just on the anterior edge of the alæ, is a broad prominent lobe or tooth, the edges sloping from this to a depression, whence they rise again before rounding off.

The teeth of the radula are in seven rows, with on each side a marginal row of thin unarmed plates. The teeth are a light horn colour, but become darker in spirit. Those of the median line have three fangs, all truncate (see Pl. IX., fig. 4), the centre one much the largest, the laterals are slightly turned outwards; those of the sub-median line have two fangs, the inner one being the largest and turned towards the median tooth, while the outer one is slightly inclined towards its sub-lateral neighbour. The teeth of the sub-lateral line are acute, stout, and much curved towards the sub-median. The laterals are slighter than the last, acute, and also curved inwards.

MEASUREMENTS.

	Inches.
Total length (including tentacular arms)	684
Body, from tip of tail to anterior margin of mantle	71
„ circumference, one foot from anterior margin	54
„ „ at centre	63
„ „ immediately in front of fin ..	45
Head, from anterior margin of mantle to root of arms	22
„ circumference	32
Eye socket, long	$5\frac{1}{2}$
„ „ deep	$3\frac{1}{2}$
Fins, longitudinal	24
„ transverse	28
"Tail"	4
Tentacular arm, length	591
„ „ circumference	$3\frac{3}{4}$
Sessile arms, first	59
„ second	62
„ third	68
„ „ circumference	12
„ fourth	95
Length of upper mandible, tip to end of palatine lamina	$4\frac{4}{20}$
Length, tip to end of frontal lamina	$2\frac{17}{20}$
Cutting edge of rostrum	$\frac{14}{20}$
„ „ ala	$\frac{11}{20}$
Tip to lateral border of frontal lamina	$1\frac{7}{20}$
Lower mandible, tip to border of mentum	$1\frac{15}{20}$
„ tip to lateral border of ala ..	$1\frac{17}{20}$
„ height of tooth	$\frac{5}{20}$

EXPLANATION OF PLATES VII.—IX.

PLATE VII.

Architeuthis longimanus. Sketch showing side-view, $\frac{1}{34}$th natural size.

PLATE VIII.

Fig. 1. Posterior portion of body, showing shape of fins.
Fig. 2. Sucker from third (sub-ventral) sessile arm. Natural size.
Fig. 3. Section of same. Natural size.
Fig. 4. Bony ring extracted from same; front view. Natural size.
Fig. 5. The same; side view, showing obliquity. Natural size.
Fig. 6. The same; lower margin, showing scarp to allow the passage of the stalk of sucker. Natural size.

Fig. 7. Bony ring from sucker of clavate portion of tentacular arm.
Fig. 8. Section of 1st (dorsal) sessile arm.
Fig. 9. Section of 2nd (sub-dorsal) sessile arm.
Fig. 10. Section of 3rd (sub-ventral) sessile arm.
Fig. 11. Section of 4th (ventral) sessile arm.

PLATE IX.

Fig. 1. Upper mandible, natural size: *a*, rostrum; *b*, notch; *c*, inner end of ala; *d*, frontal lamina; *e*, palatine lamina; *ab*, cutting edge of rostrum; *bc*, cutting edge of ala.
Fig. 2. Lower mandible, natural size: *a*, rostrum; *b*, notch; *ab*, cutting edge of rostrum; *c*, inner end of ala; *d*, mentum, or chin; *e*, gular lamina.
Fig. 3. Both jaws in position (closed) and surrounded by the inner buccal membrane. Natural size.
Fig. 4. One line of teeth from the odontophore, enlarged: *a*, median, *b*, sub-median; *c*, sub-lateral; *d*, lateral.

ART. VII.—*Note on the Female of* Anas boschas *assuming the Plumage of the Male.*

By TAYLOR WHITE.

[*Read before the Hawke's Bay Philosophical Institute, 14th November,* 1887.]

SOME eight years ago I made a present of a drake and two ducks, bred by myself from tame English Wild Duck, or Coloured Call Duck, which I obtained from the Dunedin Acclimatisation Society, to a Mr. Baker. A pair of the original birds are now in the possession of Mr. Richard Harding, Waipukurau. During January last I noticed the peculiar plumage of the duck. The beak was, as usual, yellow mottled with black, head and neck grey brown, as customary. The rest of the bird was coloured as a mallard in winter plumage, although the colouring might be a trifle more pronounced; curled tail-feathers absent; voice normal. Her mate, the mallard, was in the usual dull plumage which they assume in the summer, without the green head or curled tail-feathers, and to a casual observer would have been picked for the female of the pair. Mr. Harding writes me, August 23rd: "The English duck has still the plumage and all the appearance of the drake, but I fancy I have noticed a slight change this last day or two, a few grey feathers showing about the head. She has not nested for the two previous years." This would make it appear she had the head green during the winter months.

ART. VIII.—*A Description of a new Species of* Coccinella *found in New Zealand.*

By W. COLENSO, F.R.S., F.L.S., etc.

[*Read before the Hawke's Bay Philosophical Institute, 11th July*, 1887.]

CLASS INSECTA.

ORDER IV. COLEOPTERA.

Tribe CLAVIPALPI.

Section TRIMERA.

Group **Coccinellidæ**, Latreille.

Genus **Coccinella**, Linn.

C. novæ-zealandiæ, sp. nov.

Sub-hemispherical, moderately gibbous, 2½ lines long. *Body*, *head*, and *legs* black; *elytra* light vermillion, spotted with black. *Head* (and *prothorax*) intensely black, glossy, sub-iridescent, with two deltoid-shaped white spots between the eyes, and two minute ones below eyes at their inner angles; *maxillary palpi* terminal joint very large, broad, and flat; *labrum* with a few fine short ciliæ-like hairs; *antennæ* tips broadly cuneate, flattish. *Prothorax* with a large pentangular (escutcheon-shape) white spot on each anterior angle of pronotum. *Elytra*, margins considerably dilated and of a brighter red, with 11 sub-orbicular spots, disposed regularly in two rows longitudinally and three rows laterally, the upper spot on sutures near base over scutellum being the largest, with a white patch at base above; the four central large and the six outer small; their edges very irregular and ragged; a circular light-red spot in the middle of each elytron, margin entire; and two obscure longitudinal veins; the whole finely powdered with excessively minute black specks, which are more thick near the sutures. *Hind-wings* rather large, dusky, mostly so about costal and sub-costal veins, with an opaque dull-reddish line on costal edge from base to near second costal cell, where it forms a squarish-oblong blotch, or kind of ptero-stigma; the sub-median vein strong and clearly marked. *Meta-sternum* white. *Abdomen* very finely and minutely hairy, with a white spot beneath at each anterior angle; tip of anal portion hairy; hairs patent. *Legs*, tarsi finely and closely hairy.

Hab. Napier; forests interior of Forty-mile Bush, Waipawa County, 1870–85; (also earlier at the north, Bay of Islands, etc.;) but always singly and very rarely met with. Mr. Hamilton has lately (1886) captured a single specimen.

Obs. Although I have long known this pretty little insect, I have never before thought of describing it: partly from the great number of species of this genus already known, which (without their equally numerous varieties), it is said, amount to upwards of a thousand[*]; partly from it so closely resembling (in its general appearance) some of our British species; and partly from its extreme rarity. I do not think I have seen, altogether, a dozen specimens in 50 years!—in this respect so widely different to what obtains of some of their commoner (yet similar) species in England. Indeed, I may truly say that the capture or sight of one of these interesting little and rare creatures—so very like the tiny "Ladybirds" of England in size, shape, colour, and spots—always served to conjure up pleasant old reminiscences of childhood, and of the old childish couplet, potently repeated in days of infancy over the pretty "Ladybirds" when caught, and watching them taking flight from one's hand:—

"Ladybird, Ladybird, fly away home,
Your house is on fire, your children are gone!"

The under-wings of this species seem to me to be much larger than those of the British species of a similar size of body; and I think this species is therefore a better flyer, more active and vigilant, and consequently more rarely at rest and difficult of capture · if, as I have supposed, its wings be larger, it may keep at a higher range on trees and shrubs in search for its natural food.

I have kept one a fortnight under glass, during which time it was in ceaseless activity, and as I did not procure for it its natural or suitable food, it fasted the whole of that period, and was as lively at the close (when I put it into spirits) as at the beginning. While in captivity, I noticed a peculiarity it had on being irritated, or alarmed, it would exude many minute drops or specks of a yellowish, sticky, semi-fluid substance on to the sides of the glass in which I kept it. I now find that this peculiarity had also been long ago observed in the Northern Hemisphere species. Westwood says. "When alarmed, they fold up their legs and emit a mucilaginous yellow fluid from the joints of the limbs, having a very powerful and disagreeable scent, and which, according to some writers, is an admirable specific against tooth-ache" (*loc. cit.*). I did not, however, notice the powerful odour mentioned by Westwood.

Although this genus is an old established and very large one, many of its species being almost cosmopolite, and the numbers of some of them innumerable, the genus is but poorly represented in New Zealand. Down to the present time only one species, *C. tasmanii*, White, has been published as belonging to this Colony, and that species was detected at least forty-five years ago;* and, judging from its specific name, I should infer that it is not endemic but is also Tasmanian, where (at Hobart Town) those ships also stayed a long time during the preceding winter. I have also detected *C. tasmanii* here in Napier, upon the leaves of the "Ngaio" tree (*Myoporum lætum*): but, like the others, only very rarely; it is a smaller insect, a little more gibbous, and black with yellow spots. In so saying I should also observe that this species, which I believe to be *C. tasmanii* from its pretty closely agreeing with the description of it given by White (and recently copied by Captain Broun in his "Manual of N.Z. Coleoptera"), differs in at least one character, *i.e.*, the two spots between its eyes are *white* and not "yellow."

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[*] "The species are difficult to discriminate, and number upwards of a thousand." ("Guide to the Study of Insects," Packard, p. 511.) "These insects are among the most variable and difficult, as to their specific discrimination, of all the Coleoptera." ("Introduction to the Classification of Insects," Westwood, vol. i., p. 396.)

Moreover, I am aware of another species (*C. concinna*) said to have been found in New Zealand, the name only being given by Captain Broun ("Manual of Coleoptera," p. 645,) on the authority of Mr. Pascoe ("Ann. Mag. Nat. Hist.," Sept., 1875); of which species Captain Broun also says: "I know nothing of the insect by literature or otherwise." This may, however, prove to be identical with this newly described one of mine.

In conclusion, Captain Broun having mentioned Mr. Pascoe's name, I may also add a few words respecting him—one of our early scientific naturalist visitors. I knew Mr. Pascoe well, both as schoolboys together and denizens of the same native town, and, also, in later years, when he was here in New Zealand as surgeon of one of H.M. ships, before the formation of the colony. At that early time Mr. Pascoe made valuable collections in New Zealand natural history, especially of birds and insects. From him I received my first complete (MSS.) list of the avifauna of New Zealand, kindly compiled by himself for me. He particularly excelled in the skinning and preparing the smaller birds, an art he had early acquired at Home. The bare mention of this—our indigenous birds—leads me on further to observe, How very different our native woods and forests are now with respect to their former inhabitants, once so very numerous! now so very scarce, and of some kinds all but extinct!

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* "Zoology: Voyage 'Erebus' and 'Terror,' Antarctic Expedition." As those ships only wintered here in our waters in 1841, and as this genus is mainly to be met with in the summer; and as I had given to the Expedition a large collection of insects (in spirits), it is not unlikely that that species was among them.

ART. IX.—*Note on the Rat that invaded Picton in March*, 1884.

By Professor F. W. HUTTON.

[*Read before the Philosophical Institute of Canterbury, 5th May,* 1887.]

MR. JAMES RUTLAND has kindly sent me four heads of this rat, and I have extracted the skull from one of them and compared it with one of *Mus maorium* from the sandhills at Shag River. The two agree in all essential points, but in the Picton rat the *foramen magnum* is rounded at the top, and the brain-case is relatively rather larger. Length of skull, 1·85 inch; width at zygomatic arch, 0·6; depth from palate, 0·415. *Foramen magnum*, height 0·17, width 0·22.

Mr. Meeson has given a good description of the rat, and has identified it, correctly I think, with *Mus maorium*.[*] The following additional particulars have been furnished me by Mr. Rutland.

The rat appears to have invaded Picton at the end of March, and to have suddenly disappeared by the 20th April. Old Maoris recognised it as the rat they used to eat in former times, and said that swarming on to the low lands periodically was always characteristic of it. Mr. Rutland says that a similar visitation, but on a smaller scale, occurred at Picton in 1878 or 1879.

These rats were often noticed climbing trees. In the Pelorus, where they stopped longer, they built nests, like birds, in trees. One in Mr. Rutland's possession had been constructed in the crown of a tree-fern, from dried leaves and the hairs of the fern-fronds. They fed on green vegetables as well as on berries.

This rat is certainly different from *Mus huegeli*, Thomas, from Fiji ("Proc. Zool. Soc.," 1880, p. 11), and I should think from *M. exulans*, Peale, also; but I have seen no full description of that species.

ART. X.—*Description of a new Land Shell, from the Province of Nelson.*

By Professor F. W. HUTTON, F.G.S.

[*Read before the Philosophical Institute of Canterbury, 1st September,* 1887.]

PARYPHANTA LIGNARIA, sp. nov.

SHELL depressed, rather solid, of five slowly increasing whorls, and, apparently, narrowly umbilicated; spire slightly elevated, forming an angle of about 135°. Whorls slightly convex and rounded at the periphery; irregularly banded in the direction of the growth lines with dark reddish-brown and pale brownish-yellow, the first two-and-a-half whorls dark, the epidermis being rubbed off. Upper surface finely irregularly granulated by deeply undulating impressed lines, lower surface smooth and polished. Interior calcareous, bluish white. Greatest diameter about 2 inches, and least diameter, 1½ inch.

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[*] "Trans. N.Z. Inst.," vol. xvii., p. 199.

The lower surface is broken off, so as to leave the shape of the umbilicus and the aperture uncertain.

The single specimen was found on the saddle between the Mokihinui and Lyell Rivers, and was lent me by Dr. Gaze, of Westport, for description.

The slowly increasing whorls and apparently narrow umbilicus ally this species to *P. hochstetteri*, from which, however, it is sufficiently distinguished by its colours, and by the finer granulation of the upper surface.

Art. XI.—*Supplement to a Monograph of New Zealand* Noctuina.

By E. Meyrick, B.A., F.E.S.

[*Read before the Philosophical Institute of Canterbury, 6th October*, 1887.]

Since writing my paper on the *Noctuina*[*], I have been enabled to again visit the British Museum, and compare the material acquired with the collection there. After a careful examination I have made several corrections in nomenclature, which are here set forth, together with the description of a small new species hitherto overlooked.

NOCTUIDÆ.

Leucania, Tr.

Leuc. griseipennis, Feld.

(*Mamestra griseipennis*, Feld., pl. cix., 22; *Chera virescens*, Butl., Cist. Ent. ii., 489; *Spaelotis inconstans*, ib. 545; *Leucania moderata*, Meyr., "Trans. N.Z. Inst.," 1886 (nec Walk.).)

This is the species described by me as *L. moderata*, Walk., which name I find to be correctly applicable to the following species; Felder's name is therefore to be adopted for this. The other synonymy is correct as published, but in this and other cases I have repeated it in full, to avoid possible confusion.

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[*] See "Trans. N.Z. Inst.," vol. xix., p. 3.

Leuc. moderata, Walk.

(*Agrotis moderata*, Walk., Suppl. 705; *Eumichtis sistens*, Gn., Ent. Mo. Mag., v., 89; *Mamestra sistens*, Meyr., "Trans. N.Z. Inst.," 1886.)

I think this species may advantageously be tranferred to this genus, the indications of crests being very slight; but it must be admitted that the species occupying the borderland between *Mamestra* and *Leucania* may be placed almost equally well in either. *L. moderata* is closely allied and very similar to *L. griseipennis*. They may be distinguished by the cilia of the hindwings, which are partially grey in *L. moderata*, wholly white in *L. griseipennis*.

Leuc. temperata, Walk.

(*Bryophila temperata*, Walk., 1648 (nec Meyr.); *Xylina inceptura*, ib., 1786; *X. deceptura*, ib., 1787.)

This is not the species described by me under the name of *Mamestra temperata*, for which a new name is proposed below; but appears to be distinct from any hitherto known to me. I have only seen the British Museum specimens, of which I could not make a proper examination, but the species appears to be a *Leucania*. The following is a short description: Terminal joint of palpi moderate; form of wing as in *L. griseipennis*; forewings grey, first and second lines whitish, inconspicuous, margined with black dots, second line evenly curved, subterminal not perceptible, cilia grey, distinctly barred with white; hindwings grey.

Mamestra, Tr.

Mam. insignis, Walk.

(*Euplexia insignis*, Walk., Suppl., 724; *Xylina turbida*, ib., 754 (*teste* Butl.); *Mamestra polychroa*, Meyr., "Trans. N.Z. Inst," 1886.)

I failed to find any specimens under the name of *turbida*, Walk.

Mam. vitiosa, Butl.

(*Apamea vitiosa*, Butl., Proc. Zool. Soc., Lond., 1877, 384, pl. xlii., 8 (nec Meyr.); *Mamestra ochthistis*, Meyr., "Trans. N.Z. Inst.," 1886.)

The species described by me as *M. vitiosa* is really the following.

Mam. proteastis, n. sp.

(*Mamestra vitiosa*, Meyr., "Trans. N.Z. Inst.," 1886 (nec Butl.)

This species is consequently re-named as above.

Mam. infensa, Walk.

(*Orthosia infensa*, Walk., 748; *Mamestra arachnias*, Meyr., "Trans. N.Z. Inst.," 1886.)

Although variable, this species is easily recognised.

Mam. phricias, n. sp.

(*Mamestra temperata*, Meyr., "Trans. N.Z. Inst.," 1886 (nec Walk.)

As noted above, Walker's *M. temperata* proves to be a quite different species; I have, therefore, re-named this one.

XANTHIA, Tr.

Xanth. purpurea, Butl.

(*Graphiphora purpurea*, Butl., Cist. Ent., ii.; *Xanthia ceramodes*, Meyr., "Trans. N.Z. Inst.," 1886.)

Butler's species was formerly unrecognised.

AGROTIS, Tr.

Agr. sericea, Butl.

(*Chersotis sericea*, Butl., Cist. Ent., ii., 490; *C. inconspicua*, ib., 545; *Agrotis sericea*, Meyr., "Trans. N.Z. Inst.," 1886; *A. inconspicua*, ib.)

After comparison of the original specimens, I have come to the conclusion that we have, under these two names, only one somewhat variable species, for which the synonymy is as above.

PLUSIADÆ.

The following additional genus and species in my collection was accidentally overlooked; it may be placed after *Rhapsa*.

HYPENODES, Gn.

Ocelli absent. Palpi very long, straight, porrected, second joint with dense roughly projecting scales above and beneath; terminal joint rather short, somewhat rough-scaled, tolerably pointed. Antennæ in male rather strongly biciliated. Thorax smooth. Abdomen with a small dorsal crest near base. Legs smooth, spurs long. Forewings with veins 6 and 7 approximated at base, 9 and 10 out of 8. Hindwings with veins 3 and 4 stalked, 6 and 7 stalked.

In the absence of ocelli and peculiar neuration of forewings this genus differs from all others of the group in New Zealand. It appears to range throughout the Northern Hemisphere, but only a few species are known.

Hyp. exsularis, n. sp.

Male.—16 mm. Head, antennæ, thorax, and abdomen whitish-ochreous, brownish-tinged; abdominal crest black. Palpi dark fuscous. Legs dark fuscous, posterior pair whitish-ochreous. Forewings elongate, posteriorly gradually dilated, costa slightly arched, hindmargin obliquely rounded; ochreous-brown, closely irrorated with rather dark fuscous; a black mark beneath costa at base; a cloudy blackish longitudinal mark in disc beyond middle; second line obscurely indicated, paler, anteriorly partly blackish-edged, from posterior extremity of discal mark to inner margin beyond middle; an oblique wedge-shaped white spot from apex, touching second line; a subterminal series of white dots; a hindmarginal row of black dots: cilia fuscous, with a basal series of whitish-ochreous dots. Hindwings pale whitish-grey; a grey transverse discal spot; a dark grey interrupted hindmarginal line; cilia grey-whitish.

Taranaki, in March; one specimen.

In the British Museum is an unnamed specimen from China, which appears to be certainly the same species; it, therefore, probably ranges through many of the South Pacific islands. From its small size and inconspicuous appearance it is doubtless often overlooked.

Art. XII.—*Notes on New Zealand* Geometrina.

By E. Meyrick, B.A., F.E.S.

[*Read before the Philosophical Institute of Canterbury, 6th October*, 1887.]

I have collected here such notes of additional localities and descriptions of new species as have accumulated since the publication of my former papers on the group. These bring up the number of recognized species to 113. To those who are desirous of discovering new species of this group, I would recommend (1) examination of the forest country north of Auckland; (2) searching unexplored mountains, at about 4,000 feet, especially in the extreme south; (3) the study of the genus *Pasiphila;* in the closely-allied genus *Eupithecia* the numerous similar species are frequently only obtainable by breeding, the small larvæ feeding principally in flower-heads or shoots and requiring special search; the presumption of similar habits here is very strong.

I hope before long to have made sufficient progress with the study of exotic material to modify and improve the classification of the group, but in the present paper I have only touched on it slightly.

LARENTIADÆ.

Probolæa, Meyr.

Prob. megaspilata, Walk.

Also from Auckland.

Arcteuthes, Meyr.

The following new species differs in some respects (small points of neuration, noted in the specific description) from *A.*

euclidiata, but I consider that the two species may at present be advantageously included in the same genus. The relationship of this to *Notoreas* is thereby rendered so strong that I think the two genera must be placed in juxtaposition.

Arct. chrysopeda, n. sp.

Male, female.—16–20 mm. Head, palpi, antennæ, thorax, abdomen, and legs black, irrorated with ochreous-yellowish or ochreous-whitish. Antennal pectinations of male: *a*, 2,; *b*, 8. Forewings with hindmargin rather obliquely rounded; 6 out of 9, 7 from above or below angle of areole, 11 from or below angle of areole; dark fuscous, or dark ochreous-brown; base somewhat irrorated with orange; four orange fasciæ, tolerably equidistant; first linear, slightly curved; second narrow, almost straight; third rather narrow, forming a short obtuse angle inwards below middle; fourth subterminal, linear, sometimes interrupted or nearly obsolete, irregularly subdentate; sometimes a discal spot partially indicated by fine orange margins: cilia brown, with obscure darker fuscous quadrate spots on basal half, alternating with obscure whitish spots on terminal half. Hindwings with colour, markings, and cilia as in forewings, but first fascia absent; second unevenly angulated in middle; third broader, sometimes preceded by a fine additional orange line; fourth broader in middle. Under-surface similar to upper, but orange markings broader and lighter; cilia barred throughout with white.

Mount Arthur (4,000 feet), in January; six specimens.

EPIPHRYNE, Meyr.

Epiphr. undosata, Feld.

Also from Napier, Mount Arthur (2,700 feet), and Lake Wakatipu.

EPICYME, Meyr.

Epic. rubropunctaria, Dbld.

Also from Auckland and Napier.

PASIPHILA, Meyr.

I am now aware that I confounded three species together under the head of *P. bilineolata*, and that there are also several other species of the genus; also, that (so far as is known at present) the New Zealand species are all endemic. My previous description may therefore be regarded as cancelled, and I now give amended descriptions of those forms known to me. I am much indebted to Mr. A. Purdie for sending me specimens of some of these; there are doubtless others to be discovered. Besides the New Zealand species, I have three (or perhaps four) from Australia, and one from Tonga and the Marshall

Islands; the genus is not yet known elsewhere. The character of the ciliation of the antennæ in the male separates the genus into three well-marked natural sections: one Australian and the Tongan species belong to section B; the other Australian species belong to section C. In all the New Zealand species, vein 6 of the forewings rises from a point with or near below 9 (varying to this extent within the same species); veins 3 and 4 of the hindwings are remote and tolerably parallel; 6 and 7, stalked.

1.	Antennæ of male, naked	*indicataria.*
	ciliated	2.
2.	Antennal ciliations short, even (½-⅔)	3.
	,, ,, long, fasciculated (3-4) ..	5.
3.	Forewings with conspicuous defined brown subterminal band, interrupted in middle..	*lichenodes.*
	,, without such band	4.
4.	Forewings with conspicuous round blackish blotch on hindmargin above middle ..	*sphragitis.*
	,, without such blotch..	*nereis*
5.	Palpi whitish-ochreous	*plinthina.*
	,, green	6.
6.	Forewings with ground-colour green	*muscosata.*
	,, ,, pale fuscous ..	*bilineolata.*

In the above tabulation *P. inductata* is not included, as I have not been able to make a proper examination of it.

§ A. Antennæ of male with long fasciculated ciliations (3–4).

Pas. plinthina, n. sp.

Male.—19 mm. Head, thorax, and abdomen whitish-ochreous, irrorated with reddish. Palpi 3, whitish-ochreous, towards base blackish beneath. Antennæ whitish-ochreous, spotted with fuscous above, ciliations 4. Legs blackish, apex of joints ochreous-whitish, posterior pair wholly pale whitish-ochreous. Forewings with hindmargin very oblique, somewhat bowed, slightly sinuate above anal angle; whitish-ochreous, suffusedly irrorated with reddish, tending to form very obscure lines; a blackish irroration towards costa on basal fourth; edge of median band marked by series of black dots on veins, anterior from ⅓ of costa to ⅖ of inner margin, curved, posterior from before ¾ of costa to ⅔ of inner margin, upper ⅔ tolerably regularly curved; a pale waved subterminal line preceded by a reddish fascia, forming a darker red spot above middle, another above anal angle, and a blackish costal spot; a black hindmarginal line: cilia ochreous-whitish, with an obscure reddish line, basal half with reddish-fuscous spots on veins. Hindwings with hindmargin unevenly rounded, upper half rather deeply sinuate; pale whitish-ochreous, with obscure waved reddish lines except towards costa; a conspicuous black discal dot before middle; posterior edge of median band and a subterminal line more strongly marked; a blackish hindmarginal line; cilia as in forewings.

Wellington, in July; one specimen received from Mr. A. Purdie.

Pas. muscosata, Walk.

(*Eupithecia muscosata*, Walk., 1246; *E. cidariaria*, Gn., "Ent. Mo. Mag.," v., 62; *Cidiaria aquosata*, Feld., pl. cxxxi., 33.)

Male, female.—20–28 mm. Head green. Palpi 3, green. Antennæ in male grey, ciliations 3, in female light ochreous ringed with black. Thorax green, with several small black spots. Abdomen green. Legs black, banded with green and whitish-ochreous, posterior pair whitish-ochreous, with base of tarsal joints fuscous. Forewings with hindmargin bowed, oblique, crenulate; green; numerous curved, waved, darker lines, irregularly marked with black; anterior edge of median band from ⅖ of costa to ⅖ of inner margin, curved; posterior edge from before ¾ of costa to ⅔ of inner margin, sinuate inwards beneath costa and above and below middle; a pale subterminal line, preceded by darker suffused spots on costa, above middle, and above anal angle; a black hindmarginal line: cilia green, tips whitish, with narrow black bars on basal half. Hindwings with hindmargin unevenly rounded, crenate; whitish, in disc slightly reddish-tinged, towards inner margin sprinkled with greenish-grey, with grey waved lines; a dark grey discal dot before middle; edges of median band black towards inner margin: hindmargin greenish, especially below middle; a black hindmarginal line; cilia greenish-whitish.

Auckland, Napier, Wellington, Nelson, Christchurch; in September, and from December to February, tolerably common.

Pas. bilineolata, Walk.

(*Eupithecia bilineolata*, Walk., 1246; *Scotosia humerata*, ib., 1862; *Eupithecia semialbata*, ib., 1708; *Helastia charybdis*, Butl., Cist. Ent., ii., 503; *H. calida*, ib., 504.)

Male, female.—20–28 mm. Head and thorax ochreous-whitish, mixed with green and light fuscous, sometimes spotted with black. Palpi 2½, green, somewhat irrorated with whitish and black. Antennæ in male light ochreous, ciliations 3, in female white ringed with black. Abdomen ochreous-whitish, mixed with fuscous and irrorated with black, with a more or less defined black median ring. Legs dark fuscous, apex of joints ochreous-whitish, posterior tibiæ suffusedly irrorated with ochreous-whitish. Forewings with hindmargin bowed, oblique, sinuate above anal angle; whitish-fuscous, towards costa and hindmargin suffused with green; numerous curved waved darker fuscous lines, partly marked with black; anterior edge of median band from ⅖ of costa to ⅖ of inner margin, curved, sometimes followed by a blackish suffusion; posterior edge from before ¾ of costa to ¾ of inner margin, sinuate beneath costa, rather projecting in middle, thence parallel to hindmargin; in female the median band and two following lines often more or less wholly suffused with white; sometimes a small curved blackish subterminal spot above anal angle; a blackish interrupted hindmarginal line: cilia light fuscous, with obscure dark fuscous quadrate spots on basal half. Hindwings with hindmargin unevenly rounded, crenulate, concave above anal angle; grey-whitish, with grey waved curved lines becoming obsolete towards costa; a dark grey discal dot before middle; edges of median band marked with blackish towards inner margin; inner and hindmargins somewhat mixed with greenish; cilia grey-whitish.

Wellington, Christchurch, and Dunedin; in March and June, tolerably common.

§ B. Antennæ of male with short even ciliations (½–⅔).

Pas. nereis, n. sp.

Male, female.—15–21 mm. Head, palpi, thorax, and abdomen grey sprinkled with blackish-grey and whitish, sides of thorax and base of abdomen (in fresh specimens) tinged with blue-greenish; palpi 2. Antennæ whitish annulated with black, ciliations in male ½. Legs blackish, middle and posterior pair irrorated with whitish, apex of all joints whitish. Forewings with hindmargin bowed, oblique, slightly sinuate above anal angle; light grey, suffused with light blue-greenish (in fresh specimens); numerous curved waved darker grey or blackish-grey lines, alternating with a partial irregular white irroration; anterior edge of median band from ⅓ of costa to ⅓ of inner margin, curved; posterior edge from ⅔ of costa to ⅔ of inner margin, sinuate inwards beneath costa, and above and below middle; median band towards margins, and a hindmarginal band interrupted beneath costa, obscurely suffused with darker grey, especially near costa; a grey discal spot, sometimes obsolete; an interrupted blackish hindmarginal line: cilia whitish, barred with grey, and with an obscure grey line, bars darker on basal half. Hindwings with hindmargin unevenly rounded; grey, with obscure darker waved lines, more distinct towards inner margin, and somewhat irrorated with white in intervals; an obscure dark grey discal spot, often merged in one of the lines; cilia as in forewings, but more obscure.

Mount Arthur (4,000 feet) and Mount Hutt (2,500 feet); in January, rather common, but apparently exclusively a mountain species.

Pas. sphragitis, n. sp.

Male.—15–18 mm. Head and thorax whitish-ochreous. Palpi 2½, whitish ochreous, sometimes greenish-tinged, and irrorated with black. Antennæ light fuscous, ciliations ⅔. Abdomen pale whitish-ochreous, with blackish ante-median and ante-apical bands. Legs blackish, apex of joints whitish-ochreous, posterior pair suffused with pale whitish-ochreous. Forewings with hindmargin bowed, oblique; whitish, towards costa and inner margin sometimes suffused with light greenish or ochreous-yellowish (latter perhaps faded); an ochreous irroration forming numerous faint waved curved lines, those within median band more or less darkened with grey; costa suffusedly irrorated with blackish-grey from base to ⅔; a fine angulated black line near base; margins of median band marked by fine black lines; anterior from ⅖ of costa to ¼ of inner margin, curved: posterior from ⅔ of costa to ¾ of inner margin, rather prominently angulated in middle, upper half twice, lower half once, slightly sinuate; a conspicuous round dark fuscous patch, mixed with black and greenish, on hindmargin above middle, and a lighter and less defined patch above anal angle; an interrupted black hindmarginal line: cilia grey-whitish, barred with grey, bars darker on basal half. Hindwings with hindmargin unevenly rounded; whitish, with grey waved lines marked with blackish towards inner margin; a dark-grey discal spot before middle; posterior edge of median band prominently angulated; cilia as in forewings.

Wellington and Christchurch, in February; four specimens.

Pas. lichenodes, Purd.

Through the kindness of Mr. Purdie I have received a specimen of this very distinct species, which is much more neatly marked than any other of the genus; I do not, however, describe it, as I make no doubt that Mr. Purdie's own description (which has not yet reached my hands) from bred specimens is much more complete and satisfactory than anything I could furnish. The palpi are 2; ciliations of antennæ in male ½.

Dunedin, in January; taken and bred by Mr. A. Purdie.

§ C. Antennæ of male wholly naked.

Pas. indicataria, Walk.

(*Eupithecia indicataria*, Walk., 1708.)

Male, female.—17–20 mm. Head and thorax whitish-ochreous mixed with green, and somewhat irrorated with black. Palpi 2½, pale ochreous, terminal joint sometimes fuscous. Antennæ light greyish-ochreous, in male rather thick, filiform. Abdomen whitish-ochreous, mixed with greenish or reddish, and irrorated with black, with a blackish median ring. Legs dark fuscous, ringed with whitish-ochreous, middle and posterior pair more or less wholly suffused with whitish-ochreous. Forewings with hindmargin bowed, oblique, slightly sinuate above anal angle; pale ochreous, sometimes suffused with pale grey and slightly greenish-tinged; numerous curved waved fuscous or dark grey lines, more or less distinct, sometimes partially marked with black; anterior edge of median band from ⅜ of costa to ⅜ of inner margin, curved; posterior edge from before ¾ of costa to ¾ of inner margin, partially blackish, indented beneath costa, sinuate inwards above and below middle; in female sometimes a white patch below middle of disc; an obscure fuscous-grey patch on hindmargin above middle, margined above and below by paler bars; a blackish hindmarginal line: cilia light ochreous or greyish-ochreous, with obscure dark fuscous spots on basal half. Hindwings with hindmargin unevenly rounded, crenulate; whitish-grey, towards inner margin ochreous-tinged, and with obscure grey waved lines; a dark-grey discal dot before middle; edges of median band marked with blackish towards inner margin; cilia grey-whitish.

Napier, Wellington, and Nelson, from December to March; tolerably common.

Pas. inductata, Walk.

(*Coremia inductata*, Walk., 1322; *Scotosia subitata*, ib., 1362.)

This is a distinct species; but I have only seen the British Museum specimens, and am unable to say to which section it belongs, or to give a proper description. The hindmargin of the forewings is more bent, and the hindwings are narrower than in any other species; ground-colour light reddish, with the margins of the median band formed by distinct black lines.*

PHRIXOGONUS, Butl.

Structure quite as in *Pasiphila*, except that in male the forewings have a tuft of scales or dilation on costa (variously formed in the different species).

There are four Australian species, besides the one from New Zealand; the latter approaches most nearly to *Pasiphila*, of which the genus is a development. The generic name was originally written by Butler as *Phrissogonus*, which is orthographically so horrific in formation that I have been obliged to reform it correctly.

Phrix. denotatus, Walk.

(*Scotosia denotata*, Walk., 1361; *Phibalapteryx parvulata*, ib., 1721.)

Male, female.—16–18 mm. Head, palpi, antennæ, thorax, abdomen, and legs dark fuscous, sometimes slightly mixed with pale ochreous; palpi 2; antennæ of male stout, quite naked; apex of tarsal joints ochreous-whitish. Forewings with costa moderately arched, hindmargin obliquely rounded; in male with a small glandular dilation on costa beyond middle, beneath which is a naked transversely striated longitudinal mark occupying space between veins 10 and 12, these veins being somewhat distorted; rather dark fuscous, with numerous very obscure waved darker lines, more or less marked with black on veins; sometimes one or two irregular whitish-ochreous fasciæ preceding median band; anterior edge of median band undefined, posterior edge from before ⅔ of costa to ⅔ of inner margin, blackish, obtusely angulated in middle, with a marked sinuation above angle, rendered conspicuous by a white crescentic mark following it, sometimes followed by a whitish-ochreous patch: cilia light fuscous, with a darker line, base spotted with dark fuscous, terminal half whitish-fuscous. Hindwings with hindmargin unevenly rounded, sinuate above middle; fuscous, with waved darker lines; posterior edge of median band angulated in middle; cilia as in forewings.

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* *Larentia infusata*, Walk., 1190, and *Eupithecia inexpiata*, ib., 1708, are specimens of this genus, but are, in my opinion, too much worn for identification.

Wellington, Blenheim, Nelson, and Christchurch; in January and February, common.

ELVIA, Walk.

Elv. glaucata, Walk.

Also from Whangarei, Auckland, and Wellington.

TATOSOMA, Butl.

Tat. agrionata, Walk.

Also from Nelson.

Tat. timora, Meyr.

Also from Wellington.

ASTHENA, Hb.

Asth. pulchraria, Dbld.

Also from Whangarei, Auckland, and Nelson.

Asth. schistaria, Walk.

Also from Whangarei and Lake Wakatipu.

CEPHALISSA, Meyr.

Ceph. deltoidata, Walk.

Also from Auckland, Napier, and Nelson.

EPYAXA, Meyr.

Ep. limonodes, n. sp.

Male.—25–26 mm. Head and thorax light ochreous-yellowish, somewhat sprinkled with dark fuscous. Palpi fuscous. Antennæ pale greyish-ochreous. Abdomen pale yellow-ochreous, segmental margins dotted with blackish. Legs dark fuscous, apex of joints pale yellowish, posterior pair suffused with whitish-yellowish. Forewings with costa strongly arched on posterior half, hindmargin sinuate, somewhat oblique; light ochreous-yellowish; a basal patch of closely placed fuscous transverse lines; four series of white dots on veins, preceded and followed by black dots; first curved, within edge of basal patch; second from 1/3 of costa to 2/5 of inner margin, followed by two fuscous lines; third from beyond 2/3 of costa to 3/4 of inner margin, rather angulated in middle, sinuate inwards above middle, preceded by three obscure fuscous lines coalescing to form a small cloudy dark patch above middle; all fuscous lines terminating in black dots on costa; a black discal dot in middle; fourth series subterminal; a subtriangular dark fuscous blotch on hindmargin beneath apex; cilia light ochreous-yellowish, tips white. Hindwings and cilia wholly pale whitish-ochreous.

Wellington; two specimens, received from Mr. G. V. Hudson, who finds it not uncommon.

Ep. subductata, Walk.

(*Larentia subductata*, Walk., 1198.)

Female.—26 mm. Head, palpi, and thorax pale greyish-ochreous, somewhat mixed with yellow-greenish, and densely irrorated with fuscous. Antennæ whitish-ochreous annulated with fuscous. Abdomen grey-whitish, densely irrorated with fuscous. Legs dark fuscous, apex of joints ochreous-whitish, middle and posterior pair irrorated with grey-whitish. Forewings with costa gently arched, hindmargin waved, slightly rounded, oblique; pale greyish-ochreous, mixed with yellow-greenish, and thinly sprinkled with fuscous, tending to form faint waved lines; three light fuscous fasciæ, each marked with three dark fuscous lines; first near base, outer edge sharply angulated above middle; second from 2/5 of costa to before middle of inner margin, slightly curved; third from 2/3 of costa to 2/3 of inner margin, outer edge somewhat prominent in middle, rather sinuate above it; a crescentic black obscurely whitish-margined discal spot; a short oblique cloudy fuscous streak from apex: cilia light fuscous, somewhat sprinkled with whitish. Hindwings light grey; a grey discal dot before middle; a median band of three darker lines, outer rather prominent in middle; faint indications of other darker lines, most distinct posteriorly; cilia grey-whitish, with two cloudy grey lines.

Auckland; one specimen in December.

Ep. rosearia, Dbld.

Also from Wellington.

Ep. semifissata, Walk.

Also from Napier, Wellington, Mount Arthur (4,500 feet), and Lake Wakatipu.

ANACHLORIS, Meyr.

An. subochraria, Dbld.

Also from Napier, Wellington, and Lake Wakatipu.

CIDARIA, Tr.

Cid. rixata, Feld.

Also from Auckland, Napier, Dunedin, and Lake Wakatipu.

Cid. purpurifera, Frdy.

Also from Dunedin and Lake Wakatipu.

Cid. callichlora, Butl.

Also from Wellington, in January.

LARENTIA, Tr.

Lar. mnesichola, n. sp.

Male, female.—28–30 mm. Head, palpi, antennæ, and thorax very pale brownish-ochreous. Abdomen ochreous-grey-whitish. Legs whitish-ochreous, anterior femora and tibiæ dark fuscous above. Forewings with costa gently arched, posteriorly more strongly, hindmargin slightly bowed, rather oblique ; very pale glossy brownish-ochreous ; four series of minute black dots on veins ; first near base ; second at ⅓, curved ; third from ¾ of costa to ⅔ of inner margin, rather prominent in middle, preceded by a cloudy fascia slightly darker than ground-colour ; fourth subterminal ; a minute black discal dot ; hindmarginal space sometimes slightly darker : cilia whitish-ochreous, tips paler. Hindwings ochreous-grey-whitish ; a cloudy indistinct pale fuscous hindmarginal fascia, containing a dentate subterminal line of ground-colour ; cilia pale whitish-ochreous.

Mount Arthur (4,000 to 4,500 feet), in January ; rather common.

Lar. præfectata, Walk.

Also from Mount Arthur (4,500 feet) and Dunedin, in January.

Lar. nephelias, Meyr.

Also from Mount Arthur (4,500 feet).

Lar. cataphracta, Meyr.

Also from Mount Arthur (4,000 to 4,700 feet).

Lar. clarata, Walk.

Also from Mount Arthur (4,000 to 4,700 feet) and Lake Wakatipu.

Lar. cosmodora, n. sp.

Female.—27 mm. Head, palpi, antennæ, thorax, abdomen, and legs whitish-ochreous, slightly brownish-tinged; abdomen with a double dorsal series of dark fuscous dots. Forewings with costa hardly perceptibly arched, hindmargin slightly rounded, oblique; whitish-ochreous, slightly yellowish-tinged; a curved irregular black line rather near base, followed by a white line; median band rather darker, tinged with yellowish-fuscous towards edges, margined with dentate black lines and outside these with white, anterior from ¼ of costa to ⅖ of inner margin, rather curved, posterior from ⅔ of costa to ¾ of inner margin, somewhat prominent beneath costa, and with a more distinct double prominence in middle; two white dentate-edged spots within median band, first beneath costa, containing small black discal dot, second on inner margin; a waved white subterminal line; a fine dark fuscous hindmarginal line interrupted into numerous dots: cilia whitish-ochreous, with dark fuscous bars hardly reaching base. Hindwings whitish-ochreous, with faint darker greyish-tinged lines; a median band of four more distinct cloudy grey lines, first three straight, fourth well-marked, rather dark fuscous, waved, somewhat prominent in middle, beneath confluent with third; a faint white subterminal line; cilia pale whitish-ochreous, with a faint greyish line tending to form spots.

Mount Arthur (4,500 feet), in January; one specimen. It is conceivable that this may be the other sex of the following species, but they are very dissimilar, and I do not at present think it probable.

Lar. bryopis, n. sp.

Male.—29–32 mm. Head, palpi, thorax, abdomen, and legs pale greyish-ochreous, slightly greenish-tinged, irrorated with blackish. Antennæ whitish, annulated with black. Forewings with costa gently arched, hindmargin somewhat rounded, rather oblique; pale greyish-ochreous, tinged with olive-greenish, irrorated with blackish grey, tending to form waved transverse lines on basal area; median band margined with dentate black lines and outside them with white; anterior from ⅕ of costa to ¼ of inner margin, curved, posterior from beyond ⅔ of costa to ⅗ of inner margin, somewhat indented above middle, with a moderate double prominence in middle; three blackish-grey subdentate lines within median band, first near and parallel to anterior edge, other two near and parallel to posterior edge, first and second tending to be confluent below middle, space between these more or less suffused with white, enclosing a small black discal spot; an obscure dentate whitish subterminal line, anteriorly margined with dark fuscous, preceded and followed by waved fuscous lines; a hindmarginal series of pairs of dark fuscous dots: cilia ochreish-grey-whitish, barred with fuscous, and with a fuscous basal line. Hindwings ochreous grey, with waved darker grey transverse lines, except towards base; a dark grey discal dot before middle; posterior edge of median band formed as in forewings, followed by an obscure whitish line and somewhat paler band; hindmarginal dots and cilia as in forewings, but more obscure,

Mount Arthur (4,500 feet), in January; not uncommon. Nearest allied to *L. beata.*

Lar. chionogramma, Meyr.

Also from Mount Arthur (3,800 feet), in January.

Lar. camelias, n. sp.

Male.—28 mm. Head, antennæ, and thorax whitish-ochreous, greyish-tinged, with a few dark fuscous scales. Palpi fuscous. Abdomen whitish-ochreous, with a double dorsal series of dark fuscous dots. Legs whitish-ochreous, irrorated with purple-reddish and dark fuscous. Forewings with costa rather sinuate in middle, on anterior half gently, on posterior half very strongly arched, hindmargin moderately sinuate below apex, bowed in middle; light greyish-ochreous, with numerous cloudy waved brown-grey transverse lines, somewhat bent near costa; a black discal dot; margin of basal patch and anterior edge of median band indicated by series of very minute white dots, preceded and followed by black points; posterior edge of median band marked by a darker line, followed by a fine white line reduced on lower half to a series of points; subterminal line represented by four cloudy blackish dots on upper half and another above anal angle: cilia greyish-ochreous (imperfect). Hindwings fuscous-whitish; a median band of four cloudy greyish lines, bent near costa; a cloudy grey spot above anal angle; cilia fuscous-whitish (imperfect).

Whangarei; one specimen in December. Immediately recognisable by the peculiar form of forewings.

Lar. falcata, Butl.

This appears to be a good species, allied to *L. camelias*, but with costa of forewings less arched posteriorly, and posterior edge of median band practically straight, not bent near costa; also much darker in general colouring. I have not yet seen any specimen except the original type.

Lar. chorica, n. sp.

Female.—25 mm. Head, palpi, antennæ, and thorax light brownish-ochreous. Abdomen yellow-ochreous, margins of segments mixed with white and black. Forewings with costa sinuate, hindmargin somewhat sinuate beneath apex, obliquely rounded; brownish-ochreous; a very slender, curved, whitish line rather near base, preceded by a small blackish spot on costa; a moderate white median band, tinged with grey, towards inner margin, enclosed by two narrow, fuscous, blackish-edged, subdentate fasciæ externally margined with slender white lines, first from ⅓ of costa to before middle of inner margin, somewhat curved, attenuated above inner margin, second from ⅗ of costa to ⅔ of inner margin, slightly curved, middle third forming a strong triangular round-toothed projection marginally suffused with black; a faintly traceable clearer white discal spot in centre of band; a slender subdentate subterminal white line; a blackish fuscous spot, finely sprinkled with white, extending along hindmargin from near apex to middle, bordered by subterminal line; an interrupted black hindmarginal line: cilia pale ochreous spotted with white and blackish (imperfect). Hindwings light yellow-ochreous, sprinkled with grey towards base; a hindmarginal row of cloudy blackish marks; cilia whitish spotted with pale ochreous.

Akaroa, in January; one specimen in the collection of Mr. R. W. Fereday. Nearest to *L. obarata*, but very distinct by absence of black discal dot, stronger projection of median band, dark fuscous hindmarginal patch, and yellow-ochreous hindwings.

Lar. cinerearia, Dbld.

Also from Whangarei, Auckland, and Nelson (to 4,000 feet).

NOTOREAS, Meyr.

Not. mechanitis, Meyr.

Also from Mount Arthur (4,000 feet).

Not. paradelpha, Meyr.

Also from Mount Arthur (4,400 feet).

Not. perornata, Walk.

Also from Mount Arthur (4,300 feet).

Not. zopyra, Meyr.

Also from Mount Arthur (4,000 feet).

Not. brephos, Walk.

Also from Wellington and Dunedin.

STATHMONYMA, Meyr.

Stath. anceps, Butl.

Also from Mount Arthur (4,000 to 4,500 feet).

DASYURIS, Gn.

Das. partheniata, Gn.

Also from Wellington and Mount Arthur (4,000 feet), in January.

ŒNOCHROMIDÆ.

DICHROMODES, Gn.

Dichr. nigra, Butl.

From an examination of the original type, and also of other specimens taken by Mr. G. V. Hudson near Wellington, I am able to affirm that the insect which I formerly identified with this species is really a distinct species, to which a name is attached below. *D. nigra* is markedly larger, blackish, without any white suffusion, the markings obsoletely darker. Wellington is at present the only authenticated locality.

Dichr. gypsotis, n. sp.

(*Cacopsodos niger*, Meyr., "Trans. N.Z. Inst.," 1883, 94 (nec Butl.)

The species is described under the above reference, and is recognisable by the white ground-colour.

THEOXENA, Meyr.

I propose to regard the *Œnochromidæ* as defined by having vein 8 of the hindwings wholly free, whilst in the *Acidaliadæ* it is closely appressed to upper margin of cell near base; this genus is therefore to be referred here.

ACIDALIADÆ.

XYRIDACMA, n. g.

Face smooth. Palpi rather short, porrected, with appressed scales, second joint somewhat thickened. Antennæ in male somewhat compressed laterally, minutely ciliated (¼). Thorax rather hairy beneath. Forewings with vein 10 touching 9 at a point, 11 anastomosing with 12 and then with 10 at a point. Hindwings with veins 6 and 7 approximated at base.

Xyr. hemipteraria, Gn.

(*Hemerophila hemipteraria*, Gn., ix., 220, pl. vi., 2.)

Male.—29 mm. Head whitish-ochreous, face brownish, a fuscous bar behind fillet. Palpi dark fuscous. Antennæ and thorax whitish-ochreous, brownish-tinged. Abdomen whitish-ochreous, with some dark fuscous scales tending to form apical bands on segments. Legs dark fuscous (posterior pair broken). Forewings with costa slightly arched, hindmargin slightly sinuate beneath apex, bowed, oblique, subdentate; whitish-ochreous, brownish-tinged, with fine scattered blackish scales towards costa and hindmargin; lines slender, brownish, first from ¼ of costa to before ⅓ of inner margin, angulated near costa, second from costa near apex to inner margin beyond middle, slightly sinuate, marked with minute blackish dots on veins; second line proceded by a fainter similar line, and towards inner margin by another; a black discal dot beyond middle; subterminal line pale, waved, preceded and followed by darker shades, above middle preceded by two small subcrescentic blackish spots: cilia whitish-ochreous, faintly spotted with brownish. Hindwings with apex acute, projecting, hindmargin almost straight, waved; whitish-ochreous, brownish tinged, with scattered blackish scales; a cloudy fuscous line from middle of costa to middle of inner margin; four fuscous lines parallel to hindmargin, first straight, second and third slightly waved, third marked with blackish above middle, fourth suffused into hindmargin; cilia as in forewings.

Auckland and Wellington, in December; two specimens. I have no doubt that this curious insect is really Guénée's species; he was not acquainted with the locality of his specimen, merely stating his belief that it was "Oceanian." The form of hindwings is unique, so far as I know.

BOARMIADÆ.

Zermizinga, Walk.

Zerm. indocilis, Walk.

This species occurs also in South-east Australia.

Boarmia, Tr.

I find that the genera *Zylobara*, Butl., and *Pseudocoremia*, Butl., are untenable, being not sufficiently distinct from this; the characters of neuration on which they depended are found to vary within the limits of the same species. I include, therefore, under this genus the five species *panagrata*, Walk., *melinata*, Feld., *productata*, Walk., *lupinata*, Feld., and *fenerata*, Feld.

Boarm. panagrata, Walk.

Also from Whangarei, Auckland, Wellington, and Dunedin.

Boarm. productata, Walk.

Also from Whangarei, Auckland, Napier, and Lake Wakatipu.

Boarm. lupinata, Feld.

Also from Nelson.

Boarm. fenerata, Feld.

Also from Auckland and Wellington.

DECLANA, Walk.

I am rather disposed to think that the genera *Detunda*, Walk., and *Epicasis*, Meyr., ought to be merged in *Declana*: the neuration varies in each species, and to a certain extent within the limits of the species, and is probably here to be regarded as of specific value only; the genus would be sufficiently recognisable as a whole by the peculiar palpi. But I have not been able to examine many individuals, and shall be glad if others would look into the question.

GONOPHYLLA, Meyr.

Gon. nelsonaria, Feld.

Also from Wellington.

CHALASTRA, Walk.

Chal. pelurgata, Walk.

Also from Whangarei, Wellington, and Nelson, in December.

AZELINA, Gn.

The genus *Stratocleis*, Meyr., is not sufficiently distinct from this, and should be united with it.

Azel. gallaria, Walk.

Also from Wellington and Dunedin, in November and January.

Azel. fortinata, Gn.

Also from Wellington and Dunedin, in December.

DREPANODES, Gn.

Drep. muriferata, Walk.

Also from Whangarei, Wellington, and Nelson, in December and January.

ART. XIII.—*Notes on New Zealand* Pyralidina.

By E. MEYRICK, B.A., F.E.S.

[*Read before the Philosophical Institute of Canterbury, 6th October*, 1887.]

PYRALIDIDÆ.

DIPLOPSEUSTIS, Meyr.

Ocelli present, concealed. Antennæ in male moderately ciliated. Labial palpi long, second joint porrected, rough-scaled, terminal joint obliquely ascending. Maxillary palpi moderate, much dilated with dense scales towards apex, obliquely truncate. Forewings with veins 4 and 5 stalked, 8 and 9 stalked out of 7. Hindwings with veins 4 and 5 stalked, 7 out of 6 near origin, anastomosing moderately with 8.

Besides the following species there are three others peculiar to Australia.

Dipl. minima, Butl.

(*Cymoriza minima*, Butl., "Proc. Zool. Soc.," 1880, 684; *Diplopseustis minima*, Meyr., "Trans. Ent. Soc. Lond.," 1884, 285.)

Male, female. - 13–16 mm. Forewings elongate-triangular, apex rounded, hindmargin oblique, with rather deep sinuous indentation above middle, and obtuse bidentate median projection; whitish-ochreous, partially brownish tinged, irrorated with dark fuscous; costa dotted with dark fuscous and white; first line obscure, pale, angulated in middle, posteriorly margined partially with dark fuscous; a black discal dot; second line whitish, anteriorly margined with dark fuscous, from ¾ of costa to ⅝ of inner margin, sinuate-curved outwards above middle; a small double blackish spot on hindmargin in indentation, and two or three dots towards anal angle: cilia ochreous-white, terminal half white, separated by a sharp dark fuscous line. Hindwings grey-whitish, greyer towards apex; a very indistinct pale posterior line; a blackish spot on hindmargin below middle; cilia as in forewings.

Auckland, Wanganui, and Christchurch, from December to March, tolerably common. Also occurs in South-east Australia, Fiji, and Formosa.

SICULODIDÆ.

For reasons developed elsewhere, I now include this group as a family of *Pyralidina*.

SICULODES, Hs.

Sic. subfasciata, Walk.

Also from Wellington. I have recorded what I believe to be the same species from Fiji.

HYDROCAMPIDÆ.

PARAPONYX, Hb.

I have explained elsewhere that *Hygraula*, Meyr., is to be merged in this genus; the ocelli, though hardly perceptible in some specimens, are in others quite apparent.

CLEPSICOSMA, n. g.

Forehead flat, very oblique. Ocelli present. Tongue well-developed. Antennæ ¾, in male — ? Labial palpi long, straight, porrected, with long loosely projecting scales, attenuated to apex, terminal joint concealed. Maxillary palpi rather long, triangularly dilated with scales, not resting on labial. Posterior tibiæ with outer spurs half inner. Forewings with veins 8 and 9 stalked, 10 closely approximated to 9 towards base, 11 oblique. Hindwings somewhat broader than forewings; veins 3, 4, 5 tolerably approximated at base, 7 from a point with 6, anastomosing with 8 to ⅓; lower median naked, internal area loosely haired.

A singular genus, presenting a combination of characters which encourages the opinion I have latterly entertained, that the *Hydrocampidæ* and *Scopariadæ* ought to be united as one family.

Cleps. iridia, n. sp.

Female.—25 mm. Head, antennæ, thorax, and abdomen whitish-ochreous; shoulders rather dark fuscous. Palpi ochreous-fuscous, maxillary paler and ochreous-whitish towards apex. Legs whitish-ochreous, anterior and middle pair rather infuscated. Forewings elongate-triangular, costa moderately arched, apex obtuse, hindmargin obliquely rounded, somewhat waved; whitish-ochreous, sprinkled with brownish-ochreous, towards middle of inner margin suffused with whitish; a streak along basal third of costa irrorated with blackish-fuscous; first line slender, blackish-fuscous, rather irregular, partially interrupted, from ⅓ of costa to ⅖ of inner margin, acutely angulated above middle; a small blackish discal spot; second line slender, white, anteriorly finely margined with blackish, serrate except on sinuation, from before ¾ of costa to ⅗ of inner margin, rather strongly curved, below middle with a very deep sinuation which is at first very narrow and parallel-sided but expands circularly to touch angle of first line and discal spot; a hindmarginal series of small cloudy blackish spots: cilia whitish-ochreous, mixed with whitish, with an interrupted fuscous line. Hindwings white, towards costa slightly ochreous-tinged; a pale ochreous-grey suffusion in disc towards base; a small cloudy grey discal spot, from which proceeds a twice sharply dentate fine dark fuscous line to middle of inner margin; a slender white serrate somewhat curved line from ¾ of costa parallel to hindmargin to middle, becoming prismatic-metallic on two lowest serrations, anteriorly margined finely with blackish, posteriorly margined with a black suffusion opposite metallic portion; space between this line and hindmargin light greyish-ochreous; a dark fuscous line along upper half of hindmargin; cilia ochreous-whitish, with a fuscous line, on lower half of hindmargin wholly whitish.

Auckland (Waitakere Ranges); one specimen, in December.

SCOPARIADÆ.

SCOPARIA, Hw.

Scop. minualis, Walk.

Also from Napier, in December.

Scop. dinodes, Meyr.

Also from Wellington.

Scop. cymatias, Meyr.

Also from Nelson.

Scop. encapna, n. sp.

Male, female.—18–20 mm. Head, palpi, antennæ, thorax, abdomen, and legs dark fuscous; palpi 2, basal joint white; antennæ in male pubescent, ciliations ⅓; legs banded with white, posterior tibiæ irrorated with white. Forewings elongate-triangular, costa almost straight, apex rounded, hindmargin straight, somewhat oblique, rounded beneath; rather dark glossy fuscous, with bronzy reflections, and a few scattered white scales; veins partially irregularly marked with black; first line slender, whitish, indistinct, posteriorly black-margined, indented in middle; orbicular small, suboval, outlined with black, touching first line; claviform small, round, black, detached, conspicuous; reniform 8-shaped, obscurely outlined with darker, separated from second line by a stronger white irroration; second line slender, whitish, anteriorly dark-margined, rather irregularly sinuate; subterminal line slender, whitish, somewhat interrupted, not touching second line: cilia fuscous, with a darker subbasal line, tips obscurely spotted with ochreous-whitish. Hindwings 1⅓; fuscous-grey, with a suffused dark fuscous hindmarginal band; cilia light fuscous, with a darker line, tips whitish.

Mount Arthur (3,800 to 4,000 feet), in January; local, but abundant where it occurred, flying wildly over the tops of bushes in the sunshine. In my tabulation of the genus it falls under the same head with the very different *S. cymatias*, from which, as well as from almost all other species of the genus, it may be immediately distinguished by the very dark hindwings. It may be placed between *S. ergatis* and *S. critica*.

Scop. pongalis, Feld.

Also from Auckland, in December.

Scop. colpota, n. sp.

Male, female.—17–18 mm. Head and thorax whitish mixed with fuscous; shoulders dark fuscous. Palpi 2¼, fuscous, with an oblique black median band, basal joint white. Antennæ fuscous, ciliations in male ½. Abdomen grey-whitish. Legs dark fuscous, banded with white, posterior pair suffused with white. Forewings elongate-triangular, costa posteriorly gently arched, apex obtuse, hindmargin oblique, slightly rounded; basal ⅖ ochreous-brown, terminated by a straight line from ⅗ of costa to ⅖ of inner margin, terminal ⅗ light-grey; a thick very oblique black streak from base of costa to ¼ of disc; first line thick, black, almost straight, preceded by a white irroration; orbicular and claviform obsolete; space between ochreous-brown colour and second line suffused with white; reniform 8-shaped, faintly outlined with grey; second line slender, whitish, anteriorly margined with grey, sinuations indented, central portion strongly curved; subterminal cloudy, whitish, interrupted and touching second line in middle; an interrupted white hindmarginal line: cilia ochreous-whitish, with a grey subbasal line. Hindwings 1⅓, very pale whitish-grey, postmedian line and hindmargin suffusedly darker grey; cilia whitish, with a grey line.

Wellington; three specimens in January. Closely allied to *S. periphanes*, and very similar; best distinguished by the form of the second line, which has both sinuations rather strongly marked and indented, and the median portion rather strongly curved, whilst in *S. periphanes* the upper sinuation is very slight, the lower imperceptible, and the median portion very slightly curved; in *S. colpota* the first line is less oblique, and not distinctly white as in *S. periphanes.*

Scop. periphanes, Meyr.

Also from Whangarei, in December.

Scop. psammitis, Meyr.

Also from Mount Arthur (4,000 feet).

Scop. epicomia, Meyr.

Also from Auckland and Nelson (to 3,800 feet), in December.

Scop. axena, Meyr.

Also from Mount Arthur (4,000 to 4,500 feet).

Scop. exilis, Knaggs.

Also from Wellington, in January.

Scop. deltophora, Meyr.

Also from Mount Arthur (4,500 feet).

Scop. trivirgata, Feld.

Also from Mount Arthur (3,800 feet), in January.

Xeroscopa, Meyr.

Xer. astragalota, Meyr.

Also from Mount Arthur (4,000 feet).

Xer. niphospora, Meyr.

Also from Mount Arthur (4,000 to 4,500 feet).

Xer. nomeutis, Meyr.

Also from Mount Arthur (4,000 feet).

CRAMBIDÆ.

Orocrambus, Meyr.

I have explained elsewhere that, as in some individuals of *O. melampetrus*, vein 8 of the hindwings is free, whilst in others it anastomoses with vein 7 in the usual way, this character cannot be used to define the genus; but that the genus is, notwithstanding, good and tenable if the distinction from *Crambus* is made to consist in the densely hairy undersurface of the thorax and coxæ. As thus defined, the genus will include *O. melampetrus*, Meyr.; *O. catacaustus*, Meyr., *O. tritonellus*, Meyr. (the two latter having been formerly placed in *Crambus*), and the following new species.

Or. mylites, n. sp.

Male, female.—23–25 mm. Head whitish-ochreous, fuscous on sides. Palpi 3½, whitish-ochreous, apex mixed with blackish. Antennæ dark fuscous, ciliations in male ¼. Thorax ochreous-fuscous, shoulders and a suffused longitudinal dorsal streak ochreous-whitish. Abdomen grey, posteriorly irrorated with ochreous-whitish, anal tuft mixed with yellow-ochreous. Legs dark grey, suffusedly irrorated with whitish-ochreous. Forewings elongate, posteriorly gradually dilated, costa hardly arched, apex obtuse, hindmargin obliquely rounded; bronzy-fuscous, more or less ochreous-tinged; a moderate straight white central longitudinal streak, irregularly irrorated with fuscous-grey, from base to hindmargin, margined above with dark fuscous from before middle to near hindmargin, and beneath by a dark fuscous attenuated streak from near base which diverges in middle and runs to hindmargin above anal angle, often accompanied at divergence by a few white scales; a white irroration towards costa about ¾; a narrow white irroration along inner margin from base to anal angle, towards base margined above with dark fuscous: cilia glossy light grey. Hindwings grey; hindmargin suffusedly darker; cilia light grey, tips whitish.

Mount Arthur (4,000 to 4,800 feet), in January; common, frequenting swampy places. Nearest to *O. catacaustus*, but easily distinguishable by the whitish dorsal streak of thorax, and the grey irroration of the white median streak of forewings.

Or. catacaustus, Meyr.

Also from Mount Arthur (4,500 feet).

CRAMBUS, F.

Cr. heliotes, n. sp.

Male, female.—15–18 mm. Head, palpi, antennæ, thorax, abdomen, and legs rather dark fuscous; palpi 3½; antennal ciliations in male ½; thorax sometimes with a slender ochreous-whitish dorsal streak indicated; posterior tibiæ suffused with whitish-ochreous. Forewings elongate, posteriorly moderately dilated, costa hardly arched, apex obtuse, hindmargin rather obliquely rounded; ochreous-brown; sometimes a few scattered black scales, sometimes a black suffusion forming strong longitudinal streaks in disc and along veins towards anal angle; sometimes an ochreous-whitish streak along submedian fold from base almost to anal angle, and a similar longitudinal streak above middle from middle of disc to near hindmargin; all these markings often quite absent · cilia glossy whitish-grey. Hindwings bright orange; base, costa, and inner margin, sometimes also hindmargin and parts of one or two veins, slenderly suffused with dark fuscous; cilia whitish-fuscous, with a cloudy darker line.

Mount Arthur (3,800 feet), in January; common in a restricted locality in one of the limestone valleys. It varies considerably, but is the only known *Crambus* with orange hindwings.

Cr. dicrenellus, Meyr.

Also from Mount Arthur (4,000 feet).

Cr. isochytus, n. sp.

Male.—34–40 mm. Head white, sides behind eyes pale ochreous. Palpi 5, light brownish-ochreous, white above and towards base beneath. Antennæ grey, flatly dentate, ciliations ⅔. Thorax pale brownish-ochreous, with a broad white dorsal stripe. Abdomen ochreous-whitish. Legs ochreous-fuscous, posterior pair ochreous-whitish. Forewings elongate, posteriorly gradually dilated, costa slightly arched, apex round-pointed, hindmargin somewhat sinuate, oblique; pale glossy brownish-ochreous, with a slight brassy tinge; a narrow white costal streak from base, rather dilated beyond middle, then attenuated to a point, terminating before apex; a moderate straight white central longitudinal streak from base to hindmargin; a moderate white streak, sometimes indistinct, attenuated at both extremities, along inner margin from base to anal angle, leaving a marginal line of ground-colour on posterior ⅔: cilia snow-white. Hindwings grey-whitish or ochreous-whitish; cilia white.

Mount Arthur (4,500 feet), in January; three specimens. One of the largest species of the genus; most like *C. dicrenellus*, but considerably larger, and distinguished by the costal streak not reaching apex, and the dorsal streak not being marginal posteriorly.

Cr. crenæus, Meyr.

Also from Mount Arthur (4,000 feet).

Cr. flexuosellus, Dbld.

Also from Whangarei, Napier, and Nelson (to 4,000 feet).

Cr. harpophorus, Meyr.

Also from Mount Arthur (4,000 feet).

THINASOTIA, Hein.

The genus formerly called by me *Thinasotia* I have since characterised as a distinct genus under the name of *Hednota*; but the following species, differing both from *Crambus* and *Hednota*, I think may remain here for the present.

Thin. claviferella, Walk.

(*Aquita claviferella* Walk., Suppl., 1765; *Aphomia strigosa*, Butl., Proc. Zool. Soc., Lond., 1877, 898, pl. xliii., 10; *Crambus strigosus*, Meyr., "Trans. N.Z. Inst.," 1882, 31.)

I have recently made this synonymic correction; Walker's type is unset, which probably led to my passing it over. The species occurs also in Tasmania and Victoria, and is therefore specially interesting.

TAUROSCOPA, n. g.

Forehead vertical; ocelli present; tongue well-developed. Antennæ ¾, in male filiform, minutely ciliated, basal joint with a small tuft of hairs. Labial palpi moderately long, porrected, clothed beneath with very long dense projecting hairs, terminal joint concealed. Maxillary palpi rather long, dilated with long rough hairs. Thorax and coxæ clothed with dense rough hairs beneath. Forewings with veins 8 and 9 stalked. Hindwings with veins 4 and 5 stalked, 6 remote from 7 at origin, 7 anastomosing shortly with 8.

Closely allied to *Hednota*, from which it differs essentially only by the densely hairy undersurface of thorax and coxæ; it therefore stands in exactly the same relation to *Hednota* as *Orocrambus* to *Crambus*.

Taur. gorgopis, n. sp.

Male.—22 mm. Head, palpi, and thorax grey, densely mixed with black. Antennæ and abdomen blackish-grey. Legs blackish-grey, apex of joints ochreous-whitish. Forewings rather elongate-triangular, costa hardly arched, apex obtuse, hindmargin rather obliquely rounded; grey, densely irrorated with black; a black dentate line near base, preceded and followed by a white irroration; lines whitish, dentate, margined with black; first from 1/3 of costa to before middle of inner margin, preceded by a blackish band, and followed by a whitish irroration; second from 4/5 of costa to 3/4 of inner margin, rather curved, indented beneath costa, preceded by a white suffused irroration on upper half: cilia grey, irrorated with black on basal half. Hindwings and cilia dark fuscous grey.

Mount Arthur (4,000 feet); one specimen, in January.

DIPTYCHOPHORA, Z.

Dipt. chrysochyta, Meyr.

Also from Whangarei, in December.

Dipt. metallifera, Butl.

Male, female.—17–20 mm. Head white, collar ochreous-yellow. Palpi externally yellow-ochreous, suffused with grey towards margins, internally white. Antennæ white. Thorax ochreous-yellow, shoulders fuscous. Abdomen whitish. Legs white, anterior tibiæ, first joint of tarsi, and apex of three terminal joints dark fuscous. Forewings triangular, costa slightly arched, apex rounded, hindmargin oblique, slightly rounded, twice sinuate-indented on upper half; ochreous-orange, somewhat deeper posteriorly; a narrow rather dark fuscous streak along costa; lines fuscous, partially indistinct; first from 1/4 of costa to before middle of inner margin, sharply angulated above middle, rather sinuate and more strongly marked beneath; second from 4/5 of costa to 3/4 of inner margin, preceded and followed by white spots on costa, strongly curved outwards above middle, sinuate beneath; a narrow-transverse inwards-curved leaden-grey-metallic discal spot; between this and hindmargin are four parallel longitudinal leaden-grey-metallic streaks, not reaching discal spot, first terminating in a white dot before apex, second and fourth touching hindmargin; two very short slender longitudinal leaden-grey-metallic marks on second line below middle; three black dots on hindmargin below middle, central subquadrate: cilia shining light-grey, with snow-white subapical, median, and supra-anal patches, and a strong blackish-grey basal line. Hindwings ochreous-white, apex more ochreous-tinged, and with a small faint greyish ante-apical spot; cilia white.

Auckland, Wellington and Nelson, in December and January; several specimens.

Dipt. selenæa, Meyr.

Also from Whangarei and Auckland, in December.

Dipt. auriscriptella, Walk.

Also from Whangarei, Auckland, and Napier, in December.

Dipt. harmonica, n. sp.

Male.—12–18 mm. Head white. Palpi white, externally ochreous-tinged, towards apex slightly infuscated. Antennæ whitish. Thorax white, with a few fuscous scales. Abdomen light grey. Legs white. Forewings triangular, costa slightly arched, apex obtuse, hindmargin oblique, twice sinuate-indented on upper half; white, suffused with pale ochreous-greyish except towards inner margin; lines very slender, dark fuscous, thickened at extremities; first from beyond ¼ of costa to middle of inner margin, strongly curved, nearly preceded on costa by a small dark fuscous oblique mark, and on lower half by a wedge-shaped dark fuscous streak from inner margin; a transverse leaden-grey-metallic discal spot, lower extremity becoming obscurely whitish-ochreous; a small dark fuscous spot on costa above this; second line from ⅔ of costa to ⅔ of inner margin, very strongly curved outwards on upper ⅗, below this slightly sinuate, margined on costa with white wedge-shaped streaks, on lower half followed by a fainter similar line enclosing a white line; a yellow-ochreous space extending from discal spot to hindmargin, interrupting second line, cut by three parallel longitudinal leaden-grey-metallic purplish-tinged streaks, not reaching discal spot, upper alone reaching hindmargin; a white almost apical oblique mark from costa, separated from white margin of second line by a fuscous suffusion; space between lower half of second line and hindmargin, yellow-ochreous, suffusedly irrorated with dark fuscous; three black dots on hindmargin below middle, central subquadrate: cilia shining metallic bronzy-grey, with a strong black basal line. Hindwings grey; cilia whitish, with a grey basal line, and a faint cloudy grey median shade.

Auckland (Waitakere Ranges), in December; two specimens.

Dipt. epiphæa, Meyr.

Also from Mount Arthur (3,800 feet).

Dipt. elaina, Meyr.

Also from Auckland, Napier, and Nelson.

PHYCITIDÆ.

Maxillary palpi not triangularly dilated. Forewings with vein 7 absent, 8 and 9 stalked. Hindwings with lower median pectinated.

Although I am now able to quote species of this and the following families as occurring in New Zealand, they are not to be regarded as forming any part of the truly indigenous fauna.

CROCYDOPORA, Meyr.

Antennæ of male shortly ciliated, with a sinuation above basal joint containing a large tuft of scales. Labial palpi rather long, porrected, second joint thickened with dense appressed scales, terminal joint short. Maxillary palpi obsolete. Forewings with veins 3 and 4 approximated at base, 5 absent, 7 absent, 8 and 9 stalked. Hindwings with vein 2 almost from angle of cell, 3 and 4 stalked, 5 absent, 6 and 7 stalked, 8 closely approximated to 7 beyond 6 but not anastomosing.

Nearly allied to the cosmopolitan *Anerastia*: only one species known.

Croc. cinigerella, Walk.

(*Nephopteryx cinigerella*, Walk., Suppl., 1719; *N. stenopterella*, Meyr., "Proc. Linn. Soc. N.S.W.," 1878, 200.)

Male, female.—16–20 mm. Forewings very elongate, narrow, slightly dilated; dark grey, finely irrorated with whitish; lines indistinct, indicated by serrate dark margins; first at ⅓, somewhat oblique, preceded on inner margin by a pale grey-reddish spot margined with dark fuscous; second at ⅘, indented above middle; a pale grey-reddish suffusion towards middle of inner margin; two black dots placed transversely in disc beyond middle. Hindwings grey.

Whangarei and Nelson, in December and January; several specimens. This species is very common in East and South Australia, frequenting dry, usually sandy, places, and coming freely to lamps. I have long been familiar with it there, but never took it in New Zealand until the summer of 1885–86, nor have I seen it in other collections; it is therefore possible that it may be a recent accidental introduction; if so, it will probably be found soon to become more common and generally distributed. But in any case it is to be considered as a strictly Australian insect, which has incidentally found its way to this country.

HOMŒOSOMA, Curt.

I have two specimens of a species closely approaching and perhaps identical with the Australian *H. vagella*, but as they are both females, and differ slightly, I think it necessary to wait for further evidence before pronouncing on their identity. *H. vagella* has similar habits to the preceding species, and a still wider range; it might therefore very well occur.

GALLERIADÆ.

Maxillary palpi very small, filiform. Forewings with vein 7 stalked with 8 and 9. Hindwings with vein 8 anastomosing with 7, lower median pectinated.

ACHROEA, Hb.

Antennæ of male filiform, simple, basal joint with a triangular projection of scales. Labial palpi very short, in male subascending, in female porrected. Maxillary palpi very short, obtuse. Forewings with veins 4 and 5 in male separate, in female stalked, 8 and 9 out of 7, 10 absent. Hindwings with veins 3 and 4 stalked, 5 absent, 7 out of 6 near origin, anastomosing with 8 to beyond middle.

Achr. grisella, F.

Male, female.—16–25 mm. Head light ochreous-yellow. Forewings elongate, not dilated. costa moderately arched, apex rounded; light fuscous, unicolorous. Hindwings tolerably pointed, light grey.

Nelson, in January; one specimen. A common European species, introduced into Australia and New Zealand by civilisation; the larva feeds on the wax in beehives (often proving extremely destructive). and also on dried fruits.

ART. XIV.—*Notes on New Zealand* Tortricina.

BY E. MEYRICK, B.A., F.E.S.

[*Read before the Philosophical Institute of Canterbury*, 6*th October*, 1887.]

GRAPHOLITHIDÆ.

STREPSICRATES, Meyr.

I propose this name for the genus which I formerly called *Strepsiceros*, the latter name being preoccupied in the *Mammalia*.

Streps. charopa, n. sp.

Male.—11–12 mm. Head, palpi, and thorax pale ochreous. Antennæ grey, notched at ⅙. Abdomen light grey, anal tuft whitish-ochreous. Legs grey, ringed with whitish-ochreous. Forewings elongate, narrow, costa gently arched, apex tolerably pointed, hindmargin slightly sinuate, rather strongly oblique; pale ochreous, somewhat suffused with deeper ochreous; a few fine scattered dark fuscous scales; a short leaden-metallic erect streak from anal angle, and a similar one before middle of hindmargin: cilia light ochreous, with an ill-defined blackish apical spot. Hindwings grey, apex tinged with whitish-ochreous; cilia grey-whitish, with a cloudy darker line.

Whangarei and Auckland, in December; two specimens.

Streps. parthenia, n. sp.

Female.—18 mm. Head, palpi, antennæ, and thorax whitish. Abdomen grey-whitish. Legs dark fuscous, ringed with whitish, posterior pair whitish. Forewings elongate, costa moderately arched, apex round-pointed, hindmargin sinuate, rather strongly oblique; light brownish-ochreous, tinged with grey towards inner margin; a broad white streak along costa from base to apex, extremities pointed, margined beneath by a blackish streak from before middle to apex; about eight fine short dark fuscous strigulæ on posterior half of costa; an erect leaden-metallic streak from anal angle, and another from middle of hindmargin, both touching margin of costal streak: cilia pale brownish-ochreous, with a blackish apical spot. Hindwings grey-whitish; cilia whitish.

Auckland (Waitakere Ranges), in December; two specimens, beaten from a small-leaved shrub in kauri forest.

TORTRICIDÆ.

Proselena, Meyr.

Pros. loxias, n. sp.

Male.—13–14 mm. Head and palpi ferruginous, face light brownish-ochreous. Antennæ blackish, obscurely spotted with whitish-ochreous, moderately biciliated (1). Thorax dark fuscous, patagia ferruginous. Abdomen dark fuscous, anal tuft brownish-ochreous. Legs ochreous-brown, banded with dark fuscous, posterior pair whitish-ochreous. Forewings elongate, parallel-sided, costa moderately arched near base, thence straight, apex obtuse, hindmargin almost straight, oblique; whitish-ochreous, marbled with pale ferruginous; basal patch somewhat mixed with deeper ferruginous and black, outer edge running from ⅓ of costa to ⅓ of inner margin, partly marked with black, sharply angulated in middle; central fascia from ⅖ of costa to before anal angle, deep ferruginous mixed with black, rather narrow, tolerably even, posterior edge becoming indistinct on lower half and merging with an equally broad patch of leaden-grey scales; a deep ferruginous semi-annular pale-centred costal spot at ⅘, mixed with black; a small deep ferruginous spot, mixed with black, before hindmargin in middle: cilia pale ochreous, with two faint greyish lines. Hindwings dark fuscous-grey, somewhat lighter towards base; cilia whitish-ochreous, obscurely suffused with grey on basal half, with a dark-grey basal line.

Mount Arthur (4,000 feet), in January; two specimens.

Pros. zatrophana, Meyr.

Also from Mount Arthur (2,600 feet).

Harmologa, Meyr.

Harm. latomana, Meyr.

Also from Mount Arthur (4,400 to 4,600 feet); common.

Harm. siræa, Meyr.

Also from Mount Arthur (4,000 to 4,500 feet); common.

EPALXIPHORA, Meyr.

Epalx. axenana, Meyr.

Also from Auckland, in December.

TORTRIX, Tr.

Tort. charactana, Meyr.

Also from Nelson.

DIPTERINA, Meyr.

Dipt. jactatana, Walk.

Also from Whangarei and Auckland.

CONCHYLIDIDÆ.

ISONOMEUTIS, n. g.

Forehead with projecting scales. Antennæ in male filiform, shortly ciliated (½). Palpi very long, straight, porrected, with rough projecting scales above and beneath, somewhat attenuated, terminal joint concealed. Thorax smooth. Posterior tibiæ smooth-scaled. Forewings with veins 3 and 4 approximated at base, 7 to hindmargin, surface with small tufts of scales. Hindwings markedly narrower than forewings, rounded; veins 3 and 4 short-stalked, 5, 6, 7 tolerably parallel, lower median naked.

This genus approaches more nearly to the European *Conchylis* than to any other, but its facies is very singular, suggesting a small dark *Scoparia*.

Is. amauropa, n. sp.

Male.—12 mm. Head, antennæ, thorax, and abdomen dark fuscous. Palpi dark fuscous, beneath white towards base, with a median longitudinal bright ferruginous streak. Legs dark fuscous, apex of joints ochreous-whitish. Forewings elongate, posteriorly considerably dilated, costa gently arched, apex rounded, hindmargin slightly rounded, rather strongly oblique; dark fuscous-grey; markings light ferruginous mixed with black, ill-defined; a small spot beneath costa near base, and another before middle; three transverse strigæ, angulated in middle, not reaching costa, first about ⅕, second and third before and beyond ⅗; a small mark beneath costa at ⅘, preceded by an obscure whitish suffusion; a hindmarginal series of small obscure black spots, separated by whitish scales: cilia dark grey, with a darker line, and a small whitish apical spot. Hindwings dark fuscous grey; an irregular sinuate black streak, mixed with light ferruginous, from centre of disc to anal angle; hindmarginal spots and cilia as in forewings.

Whangarei; one specimen, in December.

HETEROCROSSA, Meyr.

Het. adreptella, Walk.

Mr. R. W. Fereday has bred this species from larvæ feeding in the shoots of the garden raspberry; its natural food is therefore doubtless the wild *Rubus*.

Het. exochana, n. sp.

Female.—21 mm. Head and thorax ochreous-white. Palpi with upper longitudinal half ochreous-white, lower dark fuscous. Antennæ, abdomen, and legs ochreous-whitish, anterior legs suffused with dark fuscous. Forewings elongate, scarcely dilated, costa moderately arched, apex round-pointed, hindmargin faintly sinuate, rather strongly oblique; pale whitish-ochreous; about ten small irregular scattered black dots in disc; a subterminal series of irregular cloudy black dots, obsolete towards costa and inner margin: cilia pale whitish-ochreous. Hindwings and cilia ochreous-whitish.

Nelson, in January; one specimen.

Het. eriphylla, n. sp.

Male.—26 mm. Head and thorax whitish-greenish, shoulders olive-greenish. Palpi whitish-greenish, apex of basal joint and a band before middle of second fuscous. Antennæ greyish-ochreous, basal joint dilated, whitish-greenish. Abdomen pale whitish-ochreous. Legs dark fuscous, apex of joints whitish, posterior pair pale whitish-ochreous. Forewings elongate, posteriorly slightly dilated, costa gently arched, apex obtuse, hindmargin straight, oblique; pale greenish, irregularly irrorated with white, especially towards hindmargin; about eight small black spots on costa, from which proceed obscure olive-green inwardly oblique strigulæ; three inwardly oblique pairs of large tufts in disc, olive-green anteriorly, white posteriorly, margined above and below by small black spots, first near base, second at ⅓, third at ⅔; a short black streak on fold between second pair, crossed by a cloudy black mark margining them anteriorly; a slender white sinuate longitudinal line in disc between second and third pairs, unevenly black-margined, crossed by three or four irregular fine white strigæ; a subterminal series of small fine irregular black marks, angulated in middle; hindmargin irregularly dotted with black scales: cilia whitish, towards base sprinkled with greenish. Hindwings and cilia whitish.

Wellington, in January; one specimen.

Art. XV.—*Descriptions of New Zealand* Tineina.

By E. Meyrick, B.A., F.E.S.

[*Read before the Philosophical Institute of Canterbury, 6th October*, 1887.]

GELECHIADÆ.

Epiphthora, n. g.

Head smooth; ocelli present; tongue well-developed. Antennæ ⅘, in male serrate, simple, basal joint elongate, with strong pecten. Labial palpi moderate, arched, ascending, second joint with appressed scales, slightly rough beneath, dilated towards apex, terminal joint short, half as long as second, slightly thickened with scales, pointed, not acute. Maxillary palpi obsolete. Posterior tibiæ clothed with long hairs above and beneath. Forewings with vein 1 furcate, 2 from ⅔ of cell, 4–7 approximated from narrow end of cell, 7 to costa, 8 absent (coincident with 7), 11 from about middle of cell. Hindwings ¼, elongate-oblong, narrow, hindmargin rectangularly emarginate beneath very strongly produced apex, cilia 4; veins 2–4 moderately remote, transverse vein absent, 5 and 6 absent, 7 to apex, 8 short, consisting almost wholly of a furcation towards base, of which the lower fork runs into 7.

A peculiar genus, with aberrant neuration.

Epiphth. melanombra, n. sp.

Male, female.—10–11 mm. Head, palpi, antennæ, thorax, abdomen and legs whitish, densely irrorated with black, appearing grey. Forewings elongate, pointed, apex subcaudate; whitish densely irrorated with black, appearing grey; a suffused blackish spot in disc before middle, another on anal angle, and a third less apparent towards apex: cilia grey, round apex whitish irrorated with black. Hindwings and cilia grey.

Christchurch; bred commonly by Mr. R. W. Fereday, in December, from larvæ mining blotches in the leaves of *Olearia avicenniæfolia* (an evergreen shrub belonging to the *Compositæ*) in November. I am indebted to his kindness for specimens.

DEPRESSARIADÆ.

Leptosaces, n. g.

Head loosely haired; no ocelli; tongue well-developed. Antennæ ⅘, in male filiform, simple, basal joint moderately elongate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, terminal joint as long as second, slender, acute. Maxillary palpi short, drooping. Abdomen tolerably flattened, in male strongly margined. Posterior tibiæ clothed with long hairs above. Forewings with vein 1 furcate, 2 from ⅘ of cell, 7 and 8 stalked, 7 to costa, 11 from middle of cell. Hindwings as broad as forewings, trapezoidal-ovate, apex and hindmargin rounded, cilia ⅔; veins 3 and 4 from a point, 6 and 7 tolerably parallel.

Lept. callixyla, n. sp.

Male, female.—16-18 mm. Head yellow-ochreous, crown mixed with dark fuscous. Palpi yellow-ochreous, terminal joint and a subapical band of second dark fuscous. Antennæ dark fuscous, in female annulated with whitish-ochreous. Thorax in male dark fuscous, in female yellow-ochreous, with shoulders and a dorsal streak dark fuscous. Abdomen grey. Legs dark fuscous, ringed with whitish-ochreous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, hindmargin very obliquely rounded; rather dark fuscous, strewn with yellow-ochreous scales, in female suffused with yellow-ochreous towards inner margin; a longitudinal yellow-ochreous streak in disc from ¼ to ¾, in female extended to base; a cloudy dark fuscous dot on this streak at ⅓, a second beyond middle, and a third on fold obliquely beyond first; a yellow-ochreous transverse line, in male ill-defined, from ⅔ of costa to anal angle, sharply angulated in middle, indented beneath costa; an irregular yellow-ochreous hindmarginal line: cilia pale yellow-ochreous, with a rather dark fuscous basal line, in male also with a fuscous median line. Hindwings and cilia grey.

Whangarei and Nelson, in December and January; two specimens, amongst forest. The differences indicated between these two specimens may be either sexual or merely individual.

ŒCOPHORIDÆ.

PELTOPHORA, Meyr.

Antennæ in male with long fine ciliations (3), basal joint with pecten. Palpi long, second joint exceeding base of antennæ, smoothly scaled, terminal joint shorter than second, slender. Thorax smooth. Forewings with vein 2 from very near angle of cell, 7 to hindmargin. Hindwings almost as broad as forewings, elongate-ovate, cilia ⅗; neuration normal.

At present represented by about twenty Australian and one European species; the following species seems truly referable here, and is presumably a straggler.

Pelt. amenena, n. sp.

Male.—22-25 mm. Head, palpi, antennæ, thorax, and abdomen pale whitish-ochreous, sometimes brownish-tinged. Legs fuscous, posterior pair whitish-ochreous. Forewings elongate, costa moderately arched, slightly sinuate in middle, apex round-pointed, hindmargin very obliquely rounded; whitish-ochreous, sometimes with scattered fuscous scales, especially on costal half anteriorly; sometimes a dark fuscous suffusion towards base of costa; two fuscous dots, somewhat obliquely placed, faintly indicated in disc before middle; a conspicuous round dark fuscous dot in disk beyond middle; sometimes a posterior transverse line indicated with dark fuscous scales, angulated in middle, indented above middle: cilia whitish-ochreous. Hindwings whitish-ochreous, greyish-tinged, more or less suffused with light fuscous-grey, except towards base; cilia pale whitish-ochreous.

Arthur's Pass (4,700 feet), and Mount Arthur (4,000 feet), in January; three specimens. Probably nearer the Tasmanian *P. cataxera* than any other described species.

SEMIOCOSMA, Meyr.

Sem. mystis, n. sp.

Differs from *S. peroneanella* only as follows: usually larger; thorax with the two dorsal black marks united in front to form an irregular bar; forewings with the black postmedian discal mark connected with the mark beneath middle of disc by a bar, and not touching costal spot above it (in *S. peroneanella* it is connected with spot above it, and not with mark beneath middle of disc); hindwings more whitish, the grey colour forming a discal spot and subterminal band (in *S. peroneanella* the grey is generally diffused posteriorly).

In my description of *S. peroneanella* this is included as a geographical (South Island) form of that species; as I now prefer to separate it as a distinct species, the said description should be corrected accordingly. The synonymy is correct as quoted.

S. peroneanella occurs at Auckland, Hamilton, Napier, and Wellington; *S. mystis* at Nelson, Christchurch, and Dunedin; both in December and January. I have seen a fair number of specimens, and the two forms appear constant.

Sem. apodoxa, n. sp.

Male, female.—21–26 mm. Head whitish, lower margin of face and maxillary palpi dark fuscous. Palpi white, second joint with lower half and a subapical ring fuscous, terminal joint with a blackish median band. Antennæ dark fuscous. Thorax whitish, with a few fuscous scales. Abdomen grey-whitish. Legs dark fuscous, posterior pair whitish. Forewings elongate, costa slightly arched, apex obtuse, hindmargin nearly straight, rather oblique; white, irregularly irrorated with light greyish-fuscous; a small fuscous spot at base of costa, and a dot near base in middle; a slender dark fuscous streak from ¼ of costa to disc before middle, its extremity furcate; a small fuscous spot beneath costa near beyond this; a fuscous-grey suffused patch towards middle third of inner margin, and a similar roundish patch above anal angle; an angulated dark fuscous mark in disc beyond middle; a short oblique irregular cloudy fuscous streak from apex; a hindmarginal row of cloudy fuscous dots: cilia whitish, irrorated with light greyish-fuscous. Hindwings grey-whitish, faintly ochreous-tinged; a faint darker discal dot; a slight greyish suffusion towards apex; cilia grey-whitish.

Wellington; three specimens received from Messrs. A. Purdie and G. V. Hudson.

Sem. platyptera, n. sp.

Male, female.—34 mm. Head and thorax fuscous, sprinkled with ochreous-whitish. Palpi fuscous, second joint mixed with white on terminal half, terminal joint with apex and a median band blackish. Antennæ fuscous. Abdomen pale greyish-ochreous. Legs dark fuscous, apex of joints ochreous-whitish, posterior tibiæ ochreous-whitish. Forewings elongate, costa gently arched, apex obtuse, hindmargin rather obliquely rounded; rather light fuscous, irregularly irrorated with black; a black streak from base to ⅓ of disc, connected with costa by a dark fuscous spot at base; numerous small scattered hardly defined dark fuscous strigulæ, some of which tend to form an irregular transverse line from ¼ of costa to anal angle; a faintly indicated pale curved transverse streak from ⅔ of costa to anal angle, preceded by a slightly darker circular suffusion in disc, and followed by a slightly darker suffusion; a hindmarginal row of cloudy dark fuscous dots: cilia ochreous-whitish, sprinkled with fuscous and dark fuscous on basal half. Hindwings pale fuscous, becoming more whitish towards base; cilia whitish, with a well-marked fuscous subbasal line.

Wellington; several specimens taken by Mr. G. V. Hudson, to whose kindness I am indebted for a type.

GYMNOBATHRA, Meyr.

Gymn. habropis, n. sp.

Male.—19–23 mm. Head, palpi, and thorax light ochreous-yellow; terminal joint of palpi white, anterior edge blackish. Antennæ dark fuscous, annulated with white. Abdomen whitish-ochreous. Legs rather dark fuscous, posterior tibiæ whitish-ochreous. Forewings elongate, posteriorly dilated, costa moderately arched, apex acute, produced, hindmargin concave, very oblique; light ochreous-yellow; a light fuscous dot in disc at ⅓, a second somewhat larger beyond middle, and a third obliquely beyond first on fold; a narrow suffused light fuscous hindmarginal fascia, darkest posteriorly, becoming obsolete towards apex: cilia pale ochreous-yellow, beneath anal angle light fuscous. Hindwings ochreous-whitish, towards apex tinged with pale fuscous; cilia ochreous-whitish, round apex fuscous-tinged.

Nelson, in January; three specimens, amongst forest.

Gymn. omphalota, n. sp.

Male, female.—12–14 mm. Head, palpi, and thorax dark fuscous mixed with pale whitish-ochreous, face whitish-ochreous. Antennæ dark fuscous, obscurely spotted with ochreous-whitish. Abdomen dark fuscous, segmental margins sharply whitish. Legs dark fuscous, ringed with whitish. Forewings elongate, costa slightly arched, apex round-pointed, hindmargin sinuate, oblique; rather dark fuscous, with greenish reflections, irregularly irrorated with ochreous-whitish, and with some scattered yellowish scales; a small round dark fuscous spot in disc before middle, and a second on fold obliquely beyond it, sometimes confluent, both sometimes margined posteriorly with whitish; a whitish dot on costa before middle; a subtriangular dark fuscous spot, mixed with yellowish and margined with blackish, in disc beyond middle, connected with costa by a dark fuscous suffusion; an irregular whitish line from ¾ of costa to anal angle, slightly bent above middle, preceded on inner margin by a small blackish spot: cilia grey-whitish, beneath anal angle grey, with a grey postmedian line, basal third ochreous-yellowish margined by a black line and tending to be spotted with blackish. Hindwings dark fuscous, lighter on basal half, with an indistinct darker discal spot; cilia fuscous-grey, with a blackish basal line.

Christchurch and Lake Wakatipu, in December; five specimens.

ŒCOPHORA, Z.

Œc. politis, n. sp.

Female.—17 mm. Head and thorax whitish-ochreous. Palpi whitish-ochreous, externally with a few dark fuscous scales. Antennæ whitish-ochreous, spotted with fuscous. Abdomen grey-whitish. Legs whitish-ochreous, anterior pair suffused with dark fuscous. Forewings elongate, not dilated, costa gently arched, apex pointed, hindmargin very obliquely rounded; whitish-ochreous; a brownish-ochreous streak, its lower margin irregularly mixed with blackish-fuscous, along fold from base to anal angle; a dark fuscous dot in disc before middle, a second at ⅔, and a third on submedian streak obliquely before first; an irregular line of dark fuscous scales from ¾ of costa to anal angle, sharply angulated in middle, indented above middle: cilia whitish-ochreous. Hindwings and cilia ochreous-grey-whitish.

Wellington; a specimen received from Mr. G. V. Hudson, who has taken others. Probably nearest to *Œ. griseata.*

CREMNOGENES, Meyr.

Cremn. siderota, n. sp.

Male, female.—16–18 mm. Head, palpi, antennæ, thorax, abdomen, and legs dark fuscous; collar ferruginous; antennæ in male clothed throughout with scattered cilia (1), with longer fasciculated series (2); patagia with small ochreous-whitish apical spot. Forewings elongate, costa moderately arched, apex obtuse, hindmargin rounded, rather strongly oblique; deep ferruginous, more or less irrorated and suffused with dark grey, especially in male; a small ill-defined yellowish spot on base of inner margin, and another beyond middle, in female much more distinct than in male; two pale leaden-grey-metallic irregular angulated transverse lines, first about ⅓, second about ¾, second in female forming a whitish-ochreous triangular spot on costa; a pale leaden-grey-metallic ring in disc beyond middle; a pale leaden-grey-metallic line from costa near before apex to anal angle, slightly bent in middle, extremities forming whitish-ochreous spots, more distinct in female: cilia dark grey, basal half light ferruginous, with a pale yellowish spot beneath anal angle. Hindwings dark fuscous-grey; cilia grey, with a darker basal line.

Mount Arthur (4,500 feet), in January; abundant on the flowers of *Aciphylla*, within a limited locality.

GLYPHIPTERYGIDÆ.

HELIOSTIBES, Z.

Head smooth; ocelli present; tongue well-developed. Antennæ ⅘, in male biciliated with fascicles (2–3), basal joint moderate, without pecten. Labial palpi moderately long, recurved, second joint exceeding base of antennæ, thickened with appressed scales, terminal joint somewhat shorter than second, acute. Maxillary palpi rudimentary. Posterior tibiæ roughly haired above and beneath on basal half. Forewings with vein 1 long-furcate, 2 from about ¾, 3–5 approximated at base, 7 and 8 stalked, 7 to about apex. Hindwings broader than forewings, oblong-ovate, cilia ⅓ – ½; veins 3 and 4 from a point, 6 and 7 tolerably parallel, 1*b* pectinated.

The position of this genus (referred here by Zeller) must be regarded at present as doubtful; it appears to be a synthetic or undeveloped type, certainly having affinities with this family, but perhaps rather to be considered as an early unspecialised form of the *Gelechiadæ.* Besides the two following, there is only one Peruvian species known.

Hel. illita, Feld.

(*Atychia illita*, Feld., pl. cxl., 32.)

Male.—21–24 mm. Head, palpi, antennæ, thorax, abdomen, and legs dark fuscous. Forewings elongate, posteriorly somewhat dilated, costa hardly arched, apex rounded-obtuse, hindmargin hardly oblique, rounded beneath; dark fuscous, irregularly mixed with deep reddish, with some scattered whitish-ochreous hair-scales; two very obscurely indicated somewhat darker spots in disc, first oblique-transverse, before middle, second sub-oblong, beyond middle; between these are a few scattered white scales; a white irroration forming an obscure transverse streak from ⅘ of costa to anal angle; four very small blackish-fuscous subquadrate costal spots between middle and apex, separated by ochreous-white spots: cilia fuscous, basal half darker and mixed with deep reddish, tips mixed with ochreous-whitish. Hindwings bright orange; a broad irregular blackish hindmarginal border, dilated at apex, and extended as a narrow attenuated streak along costa to base; inner margin suffused with blackish; a more or less defined irregular black streak from base to hindmarginal band beneath middle, sometimes reduced to a partial irroration · cilia orange, tips paler, base generally blackish on upper half of hindmargin.

Var. a. Thorax and forewings almost wholly suffused with bright ferruginous, all markings absent.

Nelson and Dunedin, in January; flies actively in the sunshine over the tops of high *Leptospermum* bushes; seems local, but common where it occurs.

Hel. atychioides, Butl.

(*Tachyptilia atychioides*, Butl., Proc. Zool. Soc. Lond., 1877, 405, pl. xliii., 14.)

Male, female.—18–16 mm. Head, palpi, and thorax dark fuscous, mixed with brownish-ochreous. Antennæ and abdomen dark fuscous. Legs dark fuscous, ringed with whitish. Forewings elongate, posteriorly somewhat dilated, costa hardly arched, apex obtuse, hindmargin nearly straight, somewhat oblique, rounded beneath; dark fuscous, thickly strewn with brownish-ochreous hair-scales; the partial obsolescence of these tends to form a streak along inner margin, an irregular transverse spot in disc before middle, a small round spot beyond middle, and an irregular narrow somewhat angulated fascia from ⅔ of costa to ¾ of inner margin; sometimes the disc is suffused with whitish except on these markings; and the fascia is margined posteriorly by a narrow whitish fascia; all these markings sometimes not traceable: cilia fuscous, base darker, tips whitish on a short space beneath apex. Hindwings dark fuscous, more or less distinctly lighter towards base (less in female), rarely with very obscure cloudy fuscous-whitish longitudinal streaks on basal half above and below median vein; cilia light fuscous or whitish, rarely clear white, with dark fuscous basal line.

Whangarei, Hamilton, Wellington, and Christchurch; common in December and January, frequenting *Leptospermum*, principally on coast sandhills.

SIMÆTHIS, Leach.

The three additional mountain species here given are superficially very similar, but are easily separated by comparison of the markings of hindwings, and the metallic markings of forewings. I have an undescribed Tasmanian species, which also approaches them nearly.

A. Forewings with metallic markings.	
1. Hindwings with white discal line reaching anal angle	*marmarea.*
2. Hindwings with white discal line interrupted above anal angle	*microlitha.*
B. Forewings without metallic markings	*symbolæa.*

Sim. microlitha, n. sp.

Male, female.—8–10 mm. Head and thorax dark bronzy-fuscous, more or less densely irrorated with white. Palpi dark fuscous, with about eight fine white transverse bars, towards base suffused with white. Antennæ black, annulated with white. Abdomen black, segmental margins sharply white. Legs black, banded with white. Forewings rather elongate, posteriorly slightly dilated, costa gently arched, apex obtuse, hindmargin slightly rounded, rather oblique; dark bronzy-fuscous; markings formed by a fine close white irroration; a small basal patch, its outer edge angulated; two angulated transverse lines near together about ⅓; a fine irregular transverse line beyond middle, more or less interrupted in disc; a thicker line, sometimes separated into two fine lines, from ⅘ of costa to anal angle; some scattered silvery-metallic scales in posterior half of wing, and a series of silvery-metallic marks from near costa at ⅔ half across wing, thence bent to near middle of hindmargin, and again bent up to apex: cilia whitish with thick blackish-fuscous basal and rather dark fuscous median lines. Hindwings ovate, evenly rounded; dark fuscous, basal half lighter and more or less whitish-tinged; a white submarginal dot at anal angle, and a fine white nearly straight short white line from very near hindmargin below middle, directed towards ¾ of costa but not nearly reaching it; cilia as in forewings.

Mount Arthur (3,900 feet), Arthur's Pass (3,000 feet), and Castle Hill (3,000 feet), in January; common amongst rank herbage.

Sim. marmarea, n. sp.

Male.—10 mm. Head, thorax, and legs dark fuscous, densely irrorated with white. Palpi dark fuscous, with about eight fine white transverse bars, towards base suffused with white. Antennæ black, annulated with white. Abdomen dark fuscous, segmental margins sharply silvery-white. Forewings rather elongate, posteriorly somewhat dilated, costa gently arched, apex obtuse, hindmargin obliquely rounded; dark bronzy-fuscous; markings formed by a fine close white irroration; a small ill-defined basal patch; two cloudy dentate angulated almost confluent transverse lines about ⅓; an irregularly angulated transverse line beyond middle, its discal portion silvery-metallic and forming a small spot above middle, separated from preceding line by a black fascia; a straight line from ¾ of costa to anal angle; a silvery-metallic submarginal streak along upper half of hindmargin: cilia whitish, with thick black basal and grey median lines. Hindwings ovate, slightly elongate, rounded; rather dark fuscous; a small cloudy white discal spot at ⅓; a strong straight white line from anal angle to disc beyond middle; above and beyond apex of this a few white scales; cilia as in forewings.

Lake Wakatipu (2,200 feet), in December; one specimen.

Sym. symbolæa, n. sp.

Male, female.—10–13 mm. Head, thorax, and legs dark fuscous irrorated with white. Palpi dark fuscous, with about eight fine white transverse bars, towards base suffused with white. Antennæ black, annulated with white. Abdomen dark fuscous, segmental margins sharply silvery-white. Forewings rather elongate, posteriorly moderately dilated, costa gently arched, apex obtuse, hindmargin somewhat oblique, nearly straight, rounded beneath; dark bronzy-fuscous; markings formed by a fine white irroration; a small basal patch, its outer edge angulated; two angulated transverse lines near together about ⅓; a fine irregularly-indented transverse line beyond middle, space between this and preceding line often partially blackish-fuscous; a cloudy line from ¾ of costa to anal angle, sometimes interrupted above middle; a white irroration towards upper half of hindmargin: cilia white, with thick black basal and dark fuscous median lines, at apex and anal angle and on a small median spot more or less wholly suffused with dark fuscous. Hindwings dark fuscous, lighter on basal half; a slightly outwards-curved fine white line from anal angle to disc at ⅔, upper portion sometimes followed by a second less-defined similar line; cilia white, with blackish fuscous basal and fuscous median lines.

Arthur's Pass (3,000 to 3,500 feet), in January; rather common.

GLYPHIPTERYX, Hb.

Glyph. zelota, n. sp.

Male, female.—12–14 mm. Head and thorax deep bronze. Palpi white, second joint with four black bands, terminal joint black in front. Antennæ and abdomen dark fuscous. Legs dark fuscous, ringed with white. Forewings elongate, posteriorly somewhat dilated, costa slightly arched, apex round-pointed, hindmargin concave, oblique; deep bronze; a straight transverse slightly oblique ochreous-white spot on inner margin at ¼, reaching half across wing, apex rounded; a similar smaller spot on inner margin beyond middle, reaching ⅓ across wing; a straight narrow oblique ochreous-white streak from costa at ⅓, reaching half across wing; two slender violet-golden-metallic fasciæ, extremities whitish, first from middle of costa to second dorsal spot, slightly curved, second from ⅔ of costa to ⅔ of inner margin, nearly straight, sometimes interrupted beneath costa; three cloudy light bronzy-ochreous fasciæ, forming whitish dots on costa, first before first metallic fascia, not passing dorsal spot, second and third beyond first and second metallic fasciæ respectively, third margined posteriorly by a straight slender violet-golden-metallic fascia which does not reach either margin; four small cloudy pale bronzy-ochreous spots beneath costa posteriorly, fourth forming an ochreous-white dot on costa; a violet-golden-metallic apical dot, above which is an ochreous-white dot; a violet-golden-metallic wedge-shaped dot on hindmargin above middle; space between third metallic fascia and hindmargin pale bronzy-ochreous, containing several undefined blackish longitudinal marks; a black suboblong anal patch, extending from third ochreous fascia, containing six round violet-golden-metallic spots in two longitudinal rows: cilia bronzy-grey, with an ochreous-white triangular indentation above middle. Hindwings dark fuscous; cilia fuscous-grey.

Whangarei, in December; seven specimens, amongst forest; a very handsome species.

Glyph. acronoma, n. sp.

Male, female.—10–11 mm. Head and thorax deep greyish-bronze, thorax with a small posterior white spot. Palpi white, second joint with four black bands, terminal joint black in front. Antennæ and abdomen dark fuscous. Legs dark fuscous, ringed with whitish. Forewings elongate, costa gently arched, apex round-pointed, hindmargin sinuate, oblique; rather deep greyish-bronze, posterior half mixed with light bronzy-ochreous; an ochreous-white oblique streak from costa at ⅓, broadest in middle, apex acute, reaching half across wing; a slender white slightly curved fascia from middle of costa to inner margin beyond middle, sometimes indistinct in disc, forming a small spot on inner margin; a silvery-blue-metallic slightly curved slender fascia from ⅜ of costa to ¾ of inner margin, becoming white at extremities; three short silvery-blue-metallic streaks from costa between this and apex, forming white dots on costa, last margining a round black apical spot; a subtriangular black anal patch, containing four round violet-golden-metallic spots: cilia grey, with a blackish line near base, interrupted by a triangular white indentation above middle. Hindwings dark grey; cilia grey.

Mount Arthur (4,000 feet), in January; two specimens.

Glyph. leptosema, n. sp.

Female.—8 mm. Head and thorax dark bronzy-fuscous. Palpi white, with four black bands. Antennæ and abdomen dark fuscous. Legs dark fuscous, ringed with ochreous-whitish. Forewings elongate, posteriorly slightly dilated, costa gently arched, apex round-pointed, hindmargin very obliquely rounded; dark bronzy-fuscous; seven oblique streaks from costa, reaching nearly half across wing, first from ⅛ of costa, most oblique, first four very slender, grey, obscure, forming minute white dots on costa, third terminating in a crescentic violet-silvery-metallic mark in disc, preceded by a violet-metallic dot, last three shorter, wedge-shaped, white, extremities violet-metallic; a slender very oblique straight streak from middle of inner margin, apex acute, not reaching half across wing, upper half ochreous-white, lower half grey; a slender violet-blue-metallic angulated fascia from costa at ⅔, between third and fourth streaks, to inner margin before anal angle, costal extremity white; an irregular violet-metallic streak along hindmargin: cilia grey, with a blackish line, interrupted by a triangular whitish indentation above middle (round apex imperfect). Hindwings narrow, dark fuscous-grey; cilia grey.

Auckland, in January; one specimen.

Glyph. nephoptera, n. sp.

Male, female.—8–11 mm. Head and thorax dark bronzy-grey. Palpi white, with four black bands, apex black in front. Antennæ and abdomen dark fuscous. Legs dark fuscous, ringed with whitish. Forewings elongate, costa gently arched, apex round-pointed, hindmargin sinuate, oblique; rather dark bronzy-fuscous or bronzy-grey, more or less densely irrorated with ochreous-whitish; in pale specimens a small dark spot in disc towards base, and a fine angulated dark transverse line about ⅔, beyond which is a whitish dot on inner margin; about eight short wedge-shaped ochreous-whitish strigulæ from costa between ⅓ and apex, first four often very obscure, fifth giving rise to a slender angulated pale golden-metallic fascia, which forms a very small whitish spot on inner margin, last three more distinct, becoming pale golden-metallic at apex; a pale golden-metallic dot on hindmargin above middle; a small round dark fuscous apical spot: cilia with basal half bronzy-grey limited by a strong black line triangularly indented above middle, terminal half white, tips grey, with a black apical hook. Hindwings rather dark fuscous-grey; cilia fuscous-grey.

Christchurch, in February and March; common on grassy volcanic hills. Allied to *G. acrothecta*, but broader-winged, and differing in numerous details.

PHRYGANOSTOLA, Meyr.

Phryg. ataracta, n. sp.

Male, female.—15–20 mm. Head, palpi, antennæ, thorax, abdomen, and legs whitish-ochreous; second joint of palpi with indications of fuscous bands; anterior legs infuscated. Forewings elongate, narrow, costa gently arched, apex in male round-pointed, in female very acute, hindmargin extremely obliquely rounded; whitish-ochreous; a few dark fuscous scales tending to form lines on veins: cilia whitish-ochreous. Hindwings pale whitish-grey, ochreous-tinged; cilia whitish-ochreous.

Mount Arthur (4,600 feet), in January; six specimens.

CIRCICA, n. g.

Head smooth; ocelli present; tongue short. Antennæ ¾, in male filiform, shortly ciliated (½), basal joint moderate, simple. Labial palpi moderate, curved, porrected or subascending, loosely rough-scaled beneath throughout, terminal joint shorter than second, pointed. Maxillary palpi obsolete. Abdomen elongate. Posterior tibiæ with appressed scales. Forewings with vein 1 furcate, 2 from near angle, 7 and 8 separate, 7 to hindmargin, 11 from before middle, secondary cell well-defined, Hindwings ¾, lanceolate, cilia 1½; veins 3 and 4 from a point, 6 and 7 rather approximated towards base.

Circ. cionophora, n. sp.

Male, female.—11–15 mm. Head, thorax, and abdomen pale whitish-ochreous. Palpi whitish. Antennæ grey. Legs fuscous, posterior pair suffused with ochreous-whitish. Forewings elongate-lanceolate, apex in female acuminate; ochreous-whitish; a moderate straight bronzy subcostal stripe from base to apex; a cloudy ochreous streak along submedian fold, more or less obsolete posteriorly: cilia ochreous-whitish. Hindwings in male grey, in female grey-whitish; cilia ochreous-whitish.

Christchurch, in February and March; common on the open volcanic hills.

Circ. xestobela, n. sp.

Male, female.—10–12 mm. Head and thorax dark bronzy-fuscous. Palpi dark fuscous, towards base whitish. Antennæ and abdomen dark fuscous. Legs dark grey, apex of joints obscurely whitish. Forewings lanceolate; rather dark greyish-bronze: cilia light grey, costal cilia white. Hindwings grey; cilia light grey, on costa grey-whitish.

Arthur's Pass (3,000 to 4,000 feet), in January; five specimens.

Pantosperma, n. g.

Head smooth; ocelli present; tongue short. Antennæ almost 1, in male serrulate, shortly ciliated (⅔), basal joint moderate, simple. Labial palpi moderate, filiform, curved, rather drooping, terminal joint as long as second, acute. Maxillary palpi absolete. Abdomen elongate. Posterior tibiæ with appressed scales. Forewings with vein 1 furcate, 2 almost from angle, 7 and 8 stalked, 7 to hindmargin, 11 from before middle. Hindwings ⅔, lanceolate, cilia 1½; veins 3 and 4 in male separate at origin, in female from a point, 6 and 7 tolerably parallel.

In one specimen examined vein 5 of the hindwings was absent, but this would appear to be an accidental deformity.

Pant. holochalca, n. sp.

Male, female.—11–14 mm. Head and thorax dark bronzy-fuscous, collar paler. Palpi bronzy-fuscous, lighter towards base. Antennæ, abdomen, and legs dark fuscous. Forewings elongate-lanceolate; deep bronze, more or less irrorated with light bronzy-ochreous: cilia bronzy. Hindwings and cilia dark fuscous.

Makatoku (Hawke's Bay), in March; common, frequenting rushes (*Juncus*) on the skirts of the forest.

PLUTELLIDÆ.

Compsistis, n. g.

Head smooth; ocelli present; tongue well-developed. Antennæ 1, in male pubescent-ciliated (½), joints closely set, basal joint elongate, without pecten. Labial palpi very long, smooth, recurved, second joint somewhat thickened, terminal joint longer than second, slender, acute. Maxillary palpi very short, appressed to tongue. Posterior tibiæ somewhat rough-haired above on basal half. Forewings with vein 1 furcate, 2 from near angle, 7 and 8 stalked, 7 to costa, 11 from middle. Hindwings 1, elongate-oblong, apex and hindmargin rounded, cilia almost 1; veins 3 and 4 from a point, 6 and 7 parallel.

Comps. bifaciella, Walk.

(*Gelechia bifaciella*, Walk., 657.)

Male, female.—10-12 mm. Head and thorax shining bronze. Palpi white, terminal joint dark fuscous. Antennæ black, with a white subapical band. Abdomen dark fuscous, beneath white. Legs blackish, banded with white. Forewings elongate, narrow, posteriorly slightly dilated, costa almost straight, apex obtuse, hindmargin obliquely rounded; basal third dark fuscous, with brassy reflections, towards costa purplish, posterior two-thirds ferruginous-orange, with a few dark fuscous scales; a shining violet-white black-margined oblique transverse spot from costa at ⅖, reaching nearly half across wing; a strongly inwards-curved pale violet-golden-metallic fascia from ⅗ of costa to anal angle, sometimes obsolete on costa; an outwards-curved pale violet-golden-metallic fascia from a small snow-white spot on costa at ¾ to anal angle, where it meets first fascia; both these fasciæ are broadest in disc, narrowed towards extremities: cilia white, with a fine black median line, above apex black, towards anal angle grey. Hindwings and cilia dark fuscous-grey.

Whangarei, Auckland, and Wellington, in December and January; common amongst forest.

MICROPTERYGIDÆ.

The four additional species here recorded are exceedingly interesting, and the two species of *Palæomicra* extremely handsome. All are most difficult to see on the wing, in fact almost invisible; much more difficult than the European species of *Micropteryx*.

MNESARCHÆA, Meyr.

In the two following species the tongue is well-developed, and vein 6 of the forewings is separate; in all other respects the structure is identical with that of *M. paracosma*. The antennæ in all the species are clothed with loose hair-scales, arranged in whorls at the joints; the spurs of the middle tibiæ are well-developed.

Mnes. loxoscia, n. sp.

Male, female.—11-12 mm. Head white. Palpi dark fuscous, apex broadly white. Antennæ whitish-ochreous, annulated with fuscous. Thorax white, patagia dark fuscous. Abdomen dark fuscous. Legs dark fuscous, apex of joints ochreous-whitish. Forewings lanceolate; white, more or less partially suffused with pale whitish-yellowish; a dark fuscous blotch occupying costal half of wing from base to ⅜, its posterior edge inwardly oblique; a dark fuscous streak along inner margin from base, gradually narrowed, terminating in an outwardly oblique triangular dark fuscous spot, the apex of which touches lower posterior angle of costal blotch; apical third of wing pale brownish-ochreous, mixed with dark fuscous and a few white scales: cilia brownish-ochreous, with small white apical and median spots, above apex and towards anal angle dark fuscous. Hindwings dark purple-fuscous; cilia rather dark fuscous.

Auckland (Waitakere Ranges), in December; common.

Mnes. hamadelpha, n. sp.

Male.—10–11 mm. Head, antennæ, and thorax whitish-ochreous. Palpi white. Abdomen dark fuscous. Legs dark fuscous, ringed with yellow-whitish. Forewings lanceolate; whitish-ochreous; a thick blackish-fuscous streak along basal half of costa, narrowed towards base, posterior extremity dilated into a vertical triangular spot reaching more than half across wing; beyond a line from ⅓ of inner margin to ⅔ of costa the ground-colour is shining golden-brownish-ochreous; a small ill-defined dark fuscous spot towards inner margin before middle; a small white spot on costa near apex, and some scattered white scales in disc below it; a black apical spot, preceded by some white scales; three ill-defined blackish spots on hindmargin, alternating with white scales: cilia golden-ochreous, with a white spot above costal spot, a small white apical spot surrounded by some black scales, a white basal dot above middle, and a white spot towards tips below middle. Hindwings rather dark purple-fuscous; cilia purplish-fuscous, with a whitish apical dot and small white median spot.

Nelson (1,500 to 8,500 feet), in January, amongst forest; four specimens.

PALÆOMICRA, Meyr.

In *P. doroxena* veins 7 and 8 of both wings are separate; the point is probably not of much importance in this group, as it only implies a small shifting of one of the variable transverse bars, and the generic definition should be widened to include this case. The genus remains distinct from *Micropteryx* by the presence of the additional branch of vein 11 of forewings.

Pal. zonodoxa, n. sp.

Male, female.—7–8 mm. Head ferruginous or pale ochreous. Palpi whitish-ochreous. Antennæ pale ochreous, with three more or less perceptible blackish bands. Thorax whitish-yellowish. Abdomen dark grey. Anterior and middle legs whitish-ochreous, apex of joints black; posterior legs dark grey, apex of joints whitish-ochreous. Forewings oblong, costa abruptly bent near base, thence gently arched, apex acute, hindmargin straight, very oblique; neuration quite as in *P. chalcophanes*: dark fuscous-purple, with bronzy reflections; extreme base whitish-yellowish; a moderately broad straight whitish-yellowish fascia before middle, generally narrowest above; a whitish-yellowish dot or small spot on costa about ¾, variable in size, sometimes absent: cilia dark grey, with a rather large pale whitish-yellowish apical spot. Hindwings dark purple-grey; cilia dark grey.

Auckland (Waitakere Ranges), in December; common in a very restricted locality amongst sedge in the kauri forest.

Pal. doroxena, n. sp.

Female.—11 mm. Head and palpi light ochreous, sides of crown brown. Antennæ dark fuscous, annulated with whitish-ochreous. Thorax ochreous-brown. Abdomen dark grey. Legs dark grey, ringed with pale ochreous. Forewings oblong, costa abruptly bent near base, thence gently arched, apex round-pointed, hindmargin straight, very oblique; neuration quite as in *P. chalcophanes*, but 7 and 8 separate; pale shining golden; two rather narrow oblique coppery-bronze fasciæ from costa near base and at ⅓, confluent on inner margin before middle; a straight rather narrow whitish-purplish fascia, margined with coppery-bronze, from middle of costa to inner margin beyond middle; a whitish-purplish black-margined transverse spot from costa at ⅔, reaching half across wing; a black semi-annular mark, its extremities touching costa at ⅘ and apex, marked with three shining whitish-purplish spots, and including a spot of ground-colour which contains a black costal dot; a semi-oval black anal blotch, not marginal except at extremities, containing three shining whitish-purplish spots near lower edge, and one in a small projection on upper edge: cilia pale golden, with blackish apical, median, and anal spots. Hindwings dark purple-grey; cilia grey.

Auckland (Waitakere Ranges), in December; one specimen amongst the kauri forest. This species is very interesting from the strong tendency of the markings to approach those of *Glyphipteryx*.

ERECHTHIADÆ.

EREUNETIS, Meyr.

This genus differs from the others of the family by the stalking of veins 6 and 7 of the forewings; it is hitherto recorded only from Australia, where there are several species.

Ereun. technica, n. sp.

Female.—12 mm. Head white, crown ochreous-tinged. Palpi white, beneath with some black scales. Antennæ white, with a black scale-streak at base. Thorax ochreous-white, with a lateral brownish-ochreous stripe. Abdomen grey. Anterior legs blackish; middle and posterior legs ochreous-white. Forewings elongate-lanceolate; greyish-ochreous, suffused with rather dark fuscous towards inner margin; markings white, faintly ochreous-tinged; a very fine longitudinal median line from base to ⅔; seven wedge-shaped strigulæ from costa, first two very oblique, reaching half across wing, first connected with base by a slender costal streak, five latter shorter and less oblique; a subtriangular spot on inner margin at ⅓, and a suboval one at ⅔; a small black apical spot: cilia light greyish-ochreous, with a blackish-grey median line on upper half, some white scales at base towards middle of hindmargin, and two diverging blackish hooks at apex. Hindwings and cilia light grey; costal cilia whitish.

Whangarei, in December; one specimen. Superficially this species has considerable resemblance with the Australian *Comodica tetracercella*, especially in the possession of the double apical hook in the cilia.

Erechthias, Meyr.

Erech. melanotricha, n. sp.

Male, female.—Only differs from *E. charadrota* in having the face and forehead wholly blackish.

Whangarei and Auckland, in December; two specimens. I think this is truly distinct from *E. charadrota*; I have taken a considerable number of the latter species at Auckland, Taranaki, Wellington, and Christchurch, from December to February, without finding any which vary in the direction of *E. melanotricha*.

TINEIDÆ.

Head densely rough-haired (rarely face smooth). Antennæ with joints closely set, transverse. Maxillary palpi generally well-developed. Forewings with vein 11 from or before middle of cell. Hindwings with veins 3 and 4 separate.

Represented in New Zealand by a few casual species, several of which are introduced.

Endophthora, n. g.

Head densely rough-haired; ocelli present; tongue obsolete. Antennæ ⅚, in male simple, joints closely set, basal joint moderate, with pecten. Labial palpi moderate, slender, somewhat arched, porrected, second joint with appressed scales, slightly rough beneath, with a few long bristles, terminal joint rather shorter than second, tolerably pointed. Maxillary palpi long, curved, drooping, filiform. Posterior tibiæ clothed with long fine hairs. Forewings with vein 1 simple, 2 from angle, 4 absent, 7 to costa, 11 from ⅓. Hindwings ⅔–¾, narrow-lanceolate, cilia 2–3; veins 5 and 6 sometimes stalked, 7 more or less approximated to 6 at base.

Besides the following, I have an undescribed Australian species.

End. omogramma, n. sp.

Female.—13-14 mm. Head and antennæ whitish-ochreous. Palpi blackish. Thorax whitish-ochreous, anterior margin narrowly black. Abdomen light grey. Legs black, ringed with whitish-ochreous, posterior pair whitish-ochreous. Forewings elongate-lanceolate; whitish-ochreous; a small elongate black spot on costa towards base, continued as a costal line to base; a smaller narrow black spot on costa before middle, beneath which are some irregular fuscous-reddish scales; a black dot on costa at $\frac{2}{3}$, beneath which is a small fuscous-reddish spot; apical fourth of wing suffused with reddish-fuscous; some black scales at apex. cilia ochreous-grey-whitish, with a cloudy blackish median line, becoming obsolete on lower half of hindmargin. Hindwings with veins 5 and 6 stalked; light grey; cilia ochreous-grey-whitish.

Auckland and Nelson, in December and January: two specimens.

End. pharotoma, n. sp.

Male, female.—8-10 mm. Head ochreous-whitish, sides fuscous. Palpi blackish, apex white. Antennæ whitish-fuscous. Thorax whitish-ochreous, with a black posterior dot, sides dark fuscous. Abdomen pale whitish-ochreous. Legs blackish, ringed with ochreous-whitish, posterior pair pale whitish-ochreous. Forewings elongate-lanceolate, narrow; light brownish-ochreous, more or less suffused with whitish-ochreous, and with a few dark fuscous scales; a rather dark fuscous elongate-triangular blotch extending along costa from base to before middle, reaching about half across wing, marked with a black spot at apex and three black spots on costa; a blackish mark in disc before middle, connected with this beneath costa, followed by an obscure ochreous-whitish bar; sometimes a blackish mark in disc beyond middle; posterior half of costa obscurely dotted with whitish and dark fuscous; some dark fuscous and black scales forming obscure spots on hindmargin: cilia whitish-ochreous, with two cloudy blackish-fuscous lines becoming obsolete towards anal angle, tending to be confluent and form a spot in middle. Hindwings with veins 5 and 6 separate; whitish-grey; cilia ochreous-whitish.

Whangarei, Palmerston, and Christchurch, from December to March: eight specimens.

End. mesotypa, n. sp.

Male, female.—10-11 mm. Head ochreous-whitish. Palpi blackish, apex white. Antennæ fuscous. Thorax whitish-ochreous, anterior margin blackish. Abdomen whitish-ochreous. Legs dark fuscous ringed with ochreous-whitish, posterior tibiæ whitish-ochreous. Forewings elongate-lanceolete; light brownish-ochreous, irregularly suffused with ochreous-whitish; two small black spots on costa towards base; a blackish longitudinal mark in disc near base; a straight rather oblique thick blackish bar from costa at ⅓, reaching more than half across wing, followed by an ochreous-whitish bar; space between these blackish markings suffused with fuscous; posterior half of costa blackish-fuscous spotted with ochreous-whitish; a small black spot in disc at ⅔, more or less distinctly bisected by a projection from an ochreous-whitish spot beneath it: cilia pale whitish-ochreous with a median row of blackish points. Hindwings with veins 5 and 6 separate; whitish-grey; cilia pale whitish-ochreous.

Auckland and Christchurch, in December; two specimens. Nearly allied to *E. pharotoma*, but distinctly less narrow-winged; the best distinctive markings appear to be the well-defined thick black bar from costa, and the obsolescence of marking in the cilia.

End. agriopa, n. sp.

Male.—9 *mm.* Head ochreous-whitish. Palpi blackish, apex white. Antennæ grey. Thorax greyish-ochreous, anterior margin dark fuscous. Abdomen grey. Legs blackish, ringed with white, posterior pair grey. Forewings elongate-lanceolate, narrow; fuscous; a slender ferruginous streak along submedian fold, suffusedly margined beneath with whitish-ochreous, and above by three cloudy blackish dots; two small black spots on costa towards base; a black wedge-shaped spot from costa before middle, reaching half across wing, followed by an ochreous-white similar spot; posterior half of costa narrowly black, with five small clear ochreous-white spots; a short longitudinal ferruginous streak in disc beyond middle; an irregular, small, white spot in disc at ¾, partially margined above with black; apex and hindmargin suffusedly irrorated with blackish: cilia ochreous-greyish, somewhat mixed with blackish, with a whitish basal dot above middle. Hindwings with veins 5 and 6 separate; dark grey; cilia grey.

Wellington, in January; one specimen. Closely allied to the two preceding, but immediately separable by the dark-grey hindwings.

SAGEPHORA, n. g.

Head shortly rough-haired; ocelli present; tongue short. Antennæ ¾, in male rather thick, filiform, simple, joints closely set, basal joint moderate, without pecten. Labial palpi moderate, rather ascending, second joint with rather rough projecting scales, beneath with a few long bristles, terminal joint somewhat shorter than second, tolerably pointed. Maxillary palpi moderate, tolerably filiform, drooping. Posterior tibiæ clothed with long dense hairs. Forewings with vein 1 simple, 2 from near angle, 7 to costa, 11 from ⅓. Hindwings 1, oblong-ovate, cilia 1; vein 4 absent, 6 and 7 tolerably parallel.

Sag. phortegella, n. sp.

Male, female.—8–13 mm. Head white. Palpi blackish, terminal joint and apex of second white. Antennæ white, terminal third black except two subapical rings. Thorax white, anterior margin blackish. Abdomen grey-whitish. Legs blackish, ringed with whitish, posterior tibiæ whitish. Forewings elongate, costa gently arched, apex round-pointed, hindmargin extremely obliquely rounded; ochreous-white; dorsal half suffusedly streaked with whitish-ochreous; a thick, gradually-dilated, blackish streak along costa from base to ¾, apex pointed, lower margin with a slight projection before middle; sometimes an irregular blackish line below middle from near base parallel to inner and hind-margins to apex, and a similar almost marginal line along inner margin to anal angle, thence as a hindmarginal streak to apex, where it is confluent with the first; sometimes a defined narrow blackish streak along inner margin, and a moderate blackish hindmarginal fascia attenuated at extremities: cilia whitish-ochreous, base within a black line ochreous-white, sometimes wholly suffused with grey. Hindwings grey or whitish-grey, rarely rather dark grey; cilia whitish-grey.

Taranaki, Makatoku, Wellington, Nelson, Otira Gorge, Christchurch, Dunedin, and Lake Wakatipu; in August, September, December, January, and March; common, frequenting forest. The species varies considerably in the presence or absence of black dorsal and hindmarginal streaks, but the varieties run into one another.

Blabophanes, Z.

Head densely rough-haired; ocelli absent; tongue short. Antennæ ⅚, in male pubescent-ciliated, with joints closely set, basal joint moderate, with small pecten. Labial palpi moderate, porrected, with tolerably appressed scales, second joint with several long bristles above and beneath at apex, terminal joint shorter than second, tolerably pointed. Maxillary palpi long, tolerably filiform, folded. Posterior tibiæ clothed with hairs. Forewings with vein 1 furcate, 2 from about angle, 3 and 4 stalked, sometimes 6 and 7 or 7 and 8 stalked, 7 to costa, 11 from near middle; a naked (usually transparent) depression in disc beneath. Hindwings 1, elongate-ovate, cilia ⅔; sometimes 5 and 6 stalked (not in New Zealand species).

A small cosmopolitan genus, of which some species are domestic and widely introduced.

Blab. ethelella, Newm.

(*Tinea ethelella*, Newm., Trans. Ent. Soc. Lond., iii. (N.S.), 288; *T. rectella*, Walk., 482; *Blabophanes namuella*, Feld., pl. cxl., 44.)

Male, female.—16-20 mm. Head pale whitish-ochreous. Palpi dark fuscous, apex ochreous-whitish. Antennæ fuscous. Thorax dark fuscous, with a broad pale whitish-ochreous dorsal stripe. Abdomen whitish grey. Legs dark fuscous, apex of joints whitish-yellowish, posterior pair pale ochreous-yellowish. Forewings elongate, costa moderately arched, apex obtuse, hindmargin very obliquely rounded; veins 6 and 7 stalked; dark fuscous; some obscure whitish-ochreous dots towards costa; a moderate clear whitish-ochreous streak along inner margin from base to anal angle, upper edge rather irregular; a well-defined transparent ochreous-whitish discal spot: cilia pale whitish-ochreous, obscurely spotted with dark fuscous, on costa more ochreous-yellowish. Hindwings rather light grey; cilia whitish-grey, becoming pale whitish-ochreous towards anal angle.

Auckland, Palmerston, Nelson (to 4,000 feet), Christchurch, and Dunedin; from October to May, generally common, often at light. Occurs also commonly in South-East Australia and Tasmania.

Blab. ferruginella, Hb.

Male.—11 mm. Much smaller than *B. ethelella*; head ferruginous-tinged; forewings with veins 6 and 7 separate, towards costa obscurely strigulated with whitish-ochreous, discal spot larger relatively, cilia pale whitish-ochreous, on costa barred with dark grey: hindwings whitish-grey, more whitish towards anal angle, cilia whitish: otherwise similar.

Taranaki, Napier, Wellington, Nelson (to 4,000 feet), and Christchurch; rather common, more or less all the year round. Introduced from Europe by civilization; now occurring also in North America and Australia.

Blab. ornithias, n. sp.

Male.—10-11 mm. Head light fuscous. Palpi dark fuscous, internally whitish. Antennæ, thorax, abdomen, and legs dark fuscous. Forewings elongate, costa gently arched, apex round-pointed, hindmargin extremely obliquely rounded; veins 6 and 7 stalked; rather dark fuscous, somewhat irrorated with paler; an obscure, cloudy, very irregular-edged whitish-ochreous streak near inner margin from base nearly to anal angle; discal spot only indicated on lower surface, not transparent: cilia rather dark fuscous. Hindwings rather dark fuscous; cilia fuscous.

Christchurch; bred from bird-nests by Mr. R. W. Fereday, to whom I am indebted for types.

TINEA, Z.

Head densely rough-haired; ocelli absent; tongue short. Antennæ ⅘, in male with joints closely set, pubescent-ciliated or simple, basal joint moderate, with or without small pecten. Labial palpi moderate, porrected, second joint shortly rough-scaled, with a few long bristles above and beneath, terminal joint shorter than second, tolerably pointed. Maxillary palpi moderate or long, tolerably filiform, more or less folded. Posterior tibiæ clothed with loose hairs. Forewings with vein 1 furcate, 2 from near angle, 7 to costa, 11 from before middle. Hindwings 1, elongate-ovate, cilia ⅔–1; sometimes 5 and 6 stalked.

Also a cosmopolitan genus, of which several species are domestic, and now widely distributed.

1.	Veins 5 and 6 of hindwings stalked	*terranea.*
	„ „ „ „ separate	2.
2.	Forewings white posteriorly	*tapetiella.*
	„ not white	3.
3.	Head whitish-ochreous	*grammocosma*
	„ more or less fuscous	4.
4.	Forewings pale greyish-ochreous, spotted with fuscous	*fuscipunctella.*
	Forewings fuscous	5.
5.	Forewings with a blackish dot in disc beyond middle	6.
	Forewings without a blackish dot in disc beyond middle	*belonota.*
6.	Cilia of forewings with terminal half whitish on hindmargin	*mochlota.*
	Cilia of forewings with terminal half fuscous ..	*certella.*

Tin. tapetiella, L.

(*Tinea tapetiella* (*tapetzella*), L.; *T. palæstrica*, Butl., Proc. Zool. Soc. Lond., 1887, 404.)

Male, female.—18–21 mm. Head white. Thorax dark fuscous. Forewings elongate, round-pointed; ochreous-white; basal ⅖ blackish-fuscous; a grey spot in disc at ⅗, and some irregularly scattered small grey spots posteriorly, especially towards anal angle; a black dot on inner margin at ⅗, and two before apex: cilia ochreous-white, round apex dark grey. Hindwings with veins 5 and 6 separate; grey; cilia ochreous-grey-whitish.

Wellington and Nelson, in January; several specimens; the larva feeds principally in furs and skins. Introduced from Europe; occurs also in Australia and North America.

Tin. grammocosma, n. sp.

Male.—16–17 mm. Head whitish-ochreous, brownish-tinged. Palpi rather long, whitish-ochreous, with a fine blackish lateral line. Antennæ whitish-ochreous, with a black scale-streak at base, ciliations ⅔. Thorax ochreous-brown mixed with whitish-ochreous. Abdomen grey. Legs fuscous, anterior tarsi dark fuscous with a longitudinal whitish-ochreous line, posterior pair whitish-ochreous. Forewings elongate-lanceolate; fuscous sprinkled with whitish-ochreous, and obscurely streaked with ferruginous; a darker longitudinal streak, partially suffused with ferruginous, below middle from base to apex, becoming dark fuscous at ⅔ and apex, margined above by a suffused whitish-ochreous streak, and beneath by a whitish-ochreous dorsal space streaked with ferruginous; a dark fuscous dot above the whitish-ochreous streak at ⅔; a fine dark fuscous hindmarginal line: cilia ochreous-whitish, mixed with light ochreous, towards anal angle suffused with ochreous. Hindwings with veins 5 and 6 separate; dark grey, purple-shining, towards base lighter and thinly scaled; cilia grey, towards anal angle grey-whitish.

Nelson, in January; two specimens in a forest ravine. The appearance of this species is quite unlike any other of the genus, and recalls some of the New Zealand species of *Gelechia*.

Tin. belonota, n. sp.

Male.—13 mm. Head whitish-fuscous. Palpi fuscous, base and apex ochreous-whitish. Antennæ, thorax, and abdomen fuscous; antennal ciliations 8. Legs dark fuscous, apex of joints ochreous-whitish. Forewings elongate, moderate, costa gently arched, apex round-pointed, hindmargin straight, very oblique; rather dark fuscous; a tolerably well-defined ochreous-whitish streak along fold from base to anal angle, upper margin with a slight projection before and a stronger one beyond middle, between which is a small dark fuscous spot: cilia rather dark fuscous, purple-shining, tips beneath apex and a small spot beneath anal angle ochreous-whitish. Hindwings with veins 5 and 6 separate; rather dark fuscous, purple-shining, lighter and thinly scaled towards base; cilia fuscous.

Palmerston (North Island), in March; one specimen amongst forest. Nearly allied to the two following, but distinctly broader-winged than either, and distinguished by the absence of discal spots, clearer pale streak, and different cilia.

Tin. certella, Walk.

(*Tinea certella*, Walk., 484.)

Male, female.—12–16 mm. Head, palpi, antennæ, thorax, and abdomen dark fuscous mixed with ochreous-whitish; antennal ciliations 2; thorax sometimes suffused with whitish. Legs dark fuscous, apex of joints ochreous-whitish. Forewings elongate, costa gently arched, apex round-pointed, hindmargin straight, very oblique; rather dark fuscous, more or less irrorated with whitish-ochreous and black; sometimes a cloudy blackish dot on fold at ¼; a cloudy blackish dot in middle of disc, a second obliquely before it on fold, and a third in disc at

¾, all variable in size and ill-defined; a very indistinct suffused short whitish-ochreous streak along fold, not reaching base; sometimes in female dorsal and hindmarginal areas broadly suffused with whitish: cilia fuscous, mixed with whitish-ochreous and dark fuscous. Hindwings with veins 5 and 6 separate; dark fuscous, purple-shining, lighter towards base, in female lighter; cilia fuscous.

Wellington and Invercargill, in January and February; not uncommon amongst forest. I should expect the larva to feed in rotten wood.

Tin. mochlota, n. sp.

Male.—10–13 mm. Head, palpi, antennæ, thorax, and abdomen fuscous; antennal ciliations 1¼. Legs dark fuscous, apex of joints ochreous-whitish. Forewings elongate, costa gently arched, apex round-pointed, hindmargin straight, very oblique; fuscous, with a few scattered grey-whitish and black scales; a cloudy black streak from submedian fold before middle to beneath middle of costa; a cloudy black dot in disc at ¾, connected with costa at ⅓ by a cloudy whitish streak: cilia fuscous, terminal half ochreous-whitish except at apex and anal angle. Hindwings with veins 5 and 6 separate; rather dark fuscous, purple-shining, lighter towards base; cilia whitish-fuscous.

Christchurch and Lake Wakatipu, in December and January; five specimens. Narrower-winged than either of the two preceding, and recognisable by the oblique antemedian bar in disc, and whitish terminal half of cilia.

Tin. fuscipunctella, Hw.

Male, female.—11–16 mm. Head light fuscous. Forewings elongate, round-pointed; pale greyish-ochreous, irregularly suffusedly spotted with fuscous; a dark fuscous dot in disc at ⅓, a second obliquely beyond it on fold, and a third, larger and more conspicuous, in disc at ⅔: cilia whitish-ochreous, basal half obscurely barred with fuscous. Hindwings with veins 5 and 6 separate; pale grey, yellowish-shining; cilia whitish-grey.

Whangarei, Palmerston, Wellington, Nelson, and Dunedin, from October to March; common, probably everywhere. Introduced from Europe; common in Australia and North America. The larva feeds on dry refuse.

Tin. terranea, Butl.

(*Scardia terranea*, Butl., Cist. Ent. ii., 510.)

Male, female.—17–27 mm. Head brownish-ochreous. Palpi ochreous, irrorated with dark fuscous, second joint with numerous bristles beneath throughout. Antennæ fuscous, in male quite simple. Thorax and abdomen greyish-ochreous, more or less suffused with fuscous. Legs dark fuscous, apex of joints pale greyish-ochreous. Forewings elongate, costa moderately arched, apex round-pointed, hindmargin extremely obliquely rounded; light greyish-ochreous, irregularly reticulated with fuscous; markings rather dark fuscous; an irregular narrow fascia from ⅙ of costa to ⅖ of inner margin; a similar somewhat broader fascia from ⅖ of costa to ⅗ of inner margin; an irregular oblique streak from costa beyond middle, not reaching anal angle; a short irregular streak from costa at ⅚, sometimes connected beneath with previous streak; two small spots on costa before this, and one before apex; a hindmarginal row of cloudy fuscous spots: cilia whitish-ochreous, barred with fuscous. Hindwings with veins 5 and 6 stalked; grey, yellowish-shining; cilia light grey, tips grey-whitish.

Wellington, Christchurch, Castle Hill (2,500 feet), Dunedin, and Lake Wakatipu, from December to February; common. The larva feeds in moss on rocks; pupa in a very dense rough cocoon amongst the moss. This species is in some respects an extreme form of the genus, but it does not seem necessary to separate it.

TINEOLA, H.-S.

Only differs from *Tinea* by the maxillary palpi, which are very short, simple; these are stated by Heinemann and others to be absent, but I find them quite distinct. The tongue appears to be absent.

Tin. bisselliella, Hum.

Male, female.—11-18 mm. Head light yellow-ochreous. Forewings elongate, round-pointed; whitish-ochreous, unicolorous. Hindwings whitish.

Christchurch and Lake Wakatipu, from December to February; probably common in houses. The larva feeds especially in the lining of chairs and sofas.

LYPUSIDÆ.

Head with loosely-appressed hairs; no tongue. Maxillary palpi absent. Forewings with vein 11 from before middle of cell. Hindwings with veins 3 and 4 separate.

Founded by Heinemann on the single European genus *Lypusa*, which differs from the two following by the absence of labial palpi, but is otherwise nearly related. I conjecture that in both the following genera the female is probably apterous.

SCORIODYTA, n. g.

Head with loosely-appressed hairs, side-tufts rather rough; ocelli present; no tongue. Antennæ ⅘, in male with joints rather closely set, wherled with scales, simple, basal joint stout, simple. Labial palpi moderate, porrected, loosely-scaled, second joint somewhat rough, with long bristles at apex above and beneath, terminal joint shorter than second, tolerably pointed. Maxillary palpi obsolete. Posterior tibiæ with tolerably-appressed scales. Forewings with vein 1 furcate, 2 from before angle, 7 to costa, 11 from before middle, secondary cell defined. Hindwings rather narrower than forewings, elongate-ovate, cilia 1; veins 6 and 7 parallel.

Scor. conisalia, n. sp.

Male.—10 mm. Head, palpi, antennæ, thorax, and abdomen fuscous. Legs dark fuscous, apex of joints ochreous-whitish, posterior tibiæ ochreous-whitish. Forewings elongate, costa gently arched, apex rounded, hindmargin very obliquely rounded; fuscous, irrorated with blackish; some scattered white scales, tending to form irregular transverse strigulæ; the absence of these appears to form darker median and subterminal fasciæ; a distinct white double spot on inner margin before middle, and a very small one before anal angle; a hindmarginal row of cloudy white dots: cilia fuscous, mixed with grey-whitish, with a cloudy dark fuscous line near base. Hindwings fuscous-grey; cilia whitish-grey, with a fuscous basal line.

Wellington, in January; seven specimens on fences. The larva doubtless feeds on lichens, and is probably a case-bearer; I saw some small empty subcylindric cases, which I conjectured to belong to this species.

MALLOBATHRA, n. g.

Head with loosely-appressed hairs; no ocelli; no tongue. Antennæ ¾, in male with joints elongate, strongly biciliated with fascicles (2½ - 4), basal joint stout, loosely scaled, with small pecten. Labial palpi moderate or short, drooping, second joint loosely rough-scaled, with two or three apical bristles, terminal joint tolerably pointed. Maxillary palpi obsolete. Posterior tibiæ with tolerably-appressed scales. Forewings with vein 1 furcate, 2 from near angle, 6 sometimes absent (*microphanes*), 7 and 8 stalked, 7 to hindmargin, 11 from before middle, secondary cell tolerably defined. Hindwings somewhat narrower than forewings, elongate-ovate: cilia ¾ – 1½; veins 6 and 7 parallel, 6 sometimes absent (*microphanes*).

It is not impossible that the absence of vein 6 in both wings of the single specimen of *M. microphanes* may prove to be an individual abnormality; but even if constant, it certainly does not call here for generic separation. The species frequent shady forest.

Mall. cratæa, n. sp.

Male.—13–14 mm. Head, palpi, antennæ, thorax, and abdomen dark fuscous; palpi short; antennal ciliations 3. Legs dark fuscous, ringed with whitish-ochreous. Forewings elongate, moderate, costa gently arched, apex rounded, hindmargin rounded, rather strongly oblique; dark fuscous, obscurely irrorated with small greyish-ochreous spots; several on posterior half of costa more distinct; a small whitish-ochreous subquadrate spot on inner margin at ⅓, and another at ⅔: cilia dark fuscous. Hindwings and cilia dark fuscous; cilia ⅔.

Mount Arthur (4,000 feet), in January; locally common.

Mall. metrosema, n. sp.

Male.—12–13 mm. Head, palpi, antennæ, and thorax pale greyish-ochreous; palpi short; antennal ciliations 4. Abdomen grey. Legs dark fuscous, ringed with whitish-ochreous, posterior tibiæ suffused with whitish-ochreous. Forewings elongate, slightly dilated posteriorly, costa gently arched, apex round-pointed, hindmargin very oblique, slightly rounded; pale greyish-ochreous, sometimes brownish-tinged; numerous small scattered irregular dark fuscous strigulæ; a very obscure ochreous-whitish streak along inner margin from ⅓ to near anal angle, interrupted by a small dark fuscous spot in middle; a straight narrow dark fuscous fascia from middle of costa to inner margin before anal angle, more or less distinctly interrupted in disc; three very small dark fuscous spots on posterior half of costa: cilia pale greyish-ochreous, fuscous-tinged. Hindwings fuscous-grey; cilia ½, light fuscous-grey.

Christchurch, in September; locally common.

Mall. microphanes, n. sp.

Male.—9 mm. Head, palpi, and antennæ light fuscous; palpi moderate; antennal ciliations 2½. Thorax fuscous. Abdomen grey. Legs grey-whitish. Forewings elongate, costa slightly arched, apex rounded, hindmargin extremely obliquely rounded; rather dark fuscous, irrorated with very obscure grey-whitish spots; costa with four more distinct small white spots on posterior half: cilia whitish-fuscous, basal half except towards anal angle fuscous obscurely spotted with whitish. Hindwings light grey; cilia 1¼, grey-whitish.

Christchurch, in August; one specimen.

ANAPHORIDÆ.

This family, closely allied to the *Tineidæ*, appears to be usually recognisable by the peculiar palpi of the male, of which the terminal joint is very long, stout, recurved, and appressed to the crown and thorax. I will not attempt to give complete family characters, since Lord Walsingham, who has recently published a paper on the group from considerable material, has unfortunately given no full generic characters nor definition of the group, but only short diagnoses of the genera. In consequence of this I am unable to say whether the following genus is really referable to the family, as I have only seen the one sex, or whether it may not be identical with one of Lord Walsingham's genera; I can only affirm that it has structures which are not mentioned as characteristic of any of his genera.

TITANOMIS, n. g.

Head shortly rough-haired on crown (face denuded); ocelli present; tongue well-developed. Antennæ with joints closely set (partly broken). Labial palpi (in female) moderate, obliquely ascending, second joint shortly rough-scaled beneath, terminal joint short, stout, obtuse. Maxillary palpi moderately long, folded. Thorax with a slight double posterior crest, beneath densely short-haired. Forewings with vein 1 strongly furcate, 2 from near angle, 3 and 4 stalked, 7 to hindmargin, 11 from middle, secondary cell well-defined. Hindwings broader than forewings, oblong-ovate, cilia ⅓; towards inner margin wholly clothed with very dense long hairs; veins tolerably parallel, forked parting-vein well-defined.

Tit. sisyrota, n. sp.

Female.—65 mm. Head, palpi, and thorax whitish suffusedly irrorated with dark fuscous (partly defaced). Antennæ fuscous. Abdomen rather dark fuscous. Anterior legs dark fuscous, apex of joints obscurely whitish (middle and posterior pair broken). Forewings elongate-oblong, costa gently arched, apex rounded, hindmargin rather oblique, slightly rounded; rather dark fuscous, irrorated with white except on an irregular posteriorly dilated median longitudinal space ceasing before hindmargin, and somewhat sprinkled with black on veins; a black streak along submedian fold from near base to beyond middle, interrupted before its apex by a subtriangular white spot; a black longitudinal streak in disc from before middle to about ¾, interrupted by a small round white spot at ⅔: cilia rather dark fuscous, barred with white (imperfect). Hindwings and cilia fuscous.

Wellington, in May; described from a specimen in poor condition, taken by Mr. G. V. Hudson, who has since obtained a second. It is much the largest Tineid of New Zealand. The larva is probably a wood-feeder. The discovery of the male is very desirable.

HYPONOMEUTIDÆ.

Head with appressed scales; tongue developed. Forewings with vein 1 furcate, 11 from before middle of cell. Hindwings with veins 3 and 4 separate.

The following genus is most allied to the South Pacific *Cyathaula.*

LYSIPHRAGMA, n. g.

Head with loosely appressed scales, side-tufts more or less rough; ocelli present; tongue short. Antennæ ⅘, in male with joints angularly projecting, pubescent-ciliated; basal joint moderate, simple. Labial palpi moderate, curved, ascending, second joint with dense rough projecting scales beneath, sometimes almost tufted towards apex, terminal joint shorter than second, broadly flattened, obtuse, scaled. Maxillary palpi long, curved, drooping, filiform. Posterior tibiæ clothed with rough hairs. Forewings with tufts of raised scales on surface; vein 1 furcate, 2 from angle, 7 to costa, 11 from $\frac{1}{8}$, secondary cell defined. Hindwings somewhat broader than forewings, elongate-ovate, cilia $\frac{3}{5}$; veins 5 and 6 stalked or approximated at origin; sometimes (§ A.) transverse vein absent, and forked parting-vein becoming a defined vein, giving rise to 4–6.

The entire absence of the transverse vein is a curious form of specific variation, but the two species are closely allied in all other respects, and are certainly to be included together. The species are forest-frequenting.

§ A. Hindwings with transverse vein absent.

Lys. mixochlora, n. sp.

Male.—18-20 mm. Head, palpi, and thorax whitish-ochreous. Antennæ whitish-ochreous, spotted with black above. Abdomen whitish-ochreous irrorated with grey. Legs dark fuscous, ringed with ochreous-whitish, posterior tibiæ ochreous-whitish. Forewings elongate, costa moderately arched, apex obtuse, hindmargin obliquely rounded; whitish-ochreous, irregularly suffused with light green; costa shortly strigulated with black from base to $\frac{3}{4}$; some scattered black scales about fold; a large transverse tuft of scales towards inner margin at $\frac{1}{4}$, followed by two black strigulæ on inner margin; a second tuft near inner margin at $\frac{1}{2}$, followed by a black dot on inner margin; a third, smaller, above anal angle; a clear ochreous-whitish subtriangular blotch on apical fourth of costa, containing some greenish scales towards apex, its lower angle obtuse, anterior and lower sides margined by an irregular wavy black line, preceded by a brownish suffusion: cilia ochreous-whitish, with a greenish line spotted with black (imperfect). Hindwings whitish-grey, yellowish-shining; cilia whitish.

Auckland and Makatoku, in December and March; two specimens.

§ B. Hindwings with transverse vein present.

Lys. epixyla, n. sp.

Male, female.—24–29 mm. Head and palpi whitish-ochreous mixed with dark fuscous. Antennæ whitish-ochreous, spotted above with dark fuscous. Thorax dark fuscous irrorated with whitish-ochreous, posterior margin sometimes whitish-ochreous. Abdomen whitish-ochreous irrorated with grey. Legs dark fuscous, suffusedly ringed with whitish-ochreous, posterior tibiæ whitish-ochreous. Forewings elongate, costa moderately arched, apex obtuse, hindmargin very obliquely rounded; whitish-ochreous, irregularly suffused with fuscous, and more or less strongly coarsely irrorated with blackish; a large tuft of scales very near base, a small one near inner margin at ¼, a third on fold opposite middle of inner margin, and a fourth above anal angle; the blackish irroration tends to form two triangular blotches, of which apex touches inner margin at ⅓ and ⅔; an ill-defined roundish ochreous-whitish ante-apical spot, preceded by a blackish-fuscous suffusion margining it: cilia fuscous, towards base irrorated with dark fuscous and very obscurely spotted with ochreous-whitish. Hindwings whitish-fuscous; cilia fuscous-whitish, with a faint darker line.

Wellington, Lake Wakatipu, and Invercargill, in December and January; several specimens, usually at rest on tree-trunks.

Art. XVI.—*On* Henops brunneus, *Hutton.*

By W. M. Maskell, F.R.M.S.

[*Read before the Wellington Philosophical Society, 11th January*, 1888.]

Plate X., fig. 1–12.

About October last, a resident in the Wairarapa District sent down to the Colonial Museum a few twigs of apple, quite covered over with some black substance, amongst which were slowly crawling about half-a-dozen rather large flies; and he desired some information on this, which he considered as a new "blight," stating that it occurred on both apple and peach trees in his garden. The specimens were referred to me; and at first sight I thought the sooty black coating to be the usual fungus accompanying scale-insects, the flies being unconnected with it. Closer examination, however, showed that the black mass was really composed of many thousands of eggs; and the flies were soon observed to be still laying more of these eggs on the twig, until in a short while it was so thickly covered with them as to be quite hidden. With the assistance of Mr. G. V. Hudson I found that the flies were undoubtedly *Henops brunneus*, a species of Dipteron hitherto only reported (in Hutton's "Catalogue of N.Z. Diptera") from Lake Wanaka. I was able to assure the gentleman who sent the specimens that probably they would not do great harm to his trees.

But the investigation so far showed that the knowledge of *Henops* hitherto possessed was incomplete. The available works in which it is mentioned were Hutton's "Catalogue" and Westwood's "Classification of Insects." In the first, the description given is very short and indefinite: in the second it is stated that *Henops* and its allied genera are very little known, and "the larvæ have not been observed." I placed one of the apple-twigs, covered with eggs, in a glass box, in the hope that the larvæ might possibly be hatched, and, after about five or six weeks, I found a perfect cloud of minute larvæ, wriggling in the liveliest manner. Having thus achieved a further stage of knowledge of this species, and the fly itself being in some respects rather a curious one, I have ventured to bring forward the following description and illustrations of the larva and the imago. Unfortunately, not being able to procure a supply of apple or peach leaves, I have not succeeded in feeding the larvæ and obtaining pupæ. I tried various leaves as food for them, as well as giving them earth to burrow in, but they all died.

ORDER. DIPTERA.

Sub-Order. OVIPARA.

Family. ACROCERIDÆ, Leach.

(*Inflatæ*, Latreille; *Vesiculosæ*, Macquart.)

Body short and thick; head bent down, small, entirely occupied by the eyes; thorax and abdomen large, inflated; proboscis variable, sometimes long, sometimes absent.

Genus **Henops**, Illiger.

(*Ogcodes*, Latreille.)

Proboscis very short, scarcely noticeable; antennæ of two short joints with a long style. Eyes naked, compound. Abdomen broader than the thorax.

Henops brunneus, Hutton.

(Catal. of Dipt., 1881, p. 25.)

Flies (fig. 1) rather large, but squat-looking and heavy; motions very slow. Thorax much elevated, the head being bent down beneath it so as not to be visible when the insect is viewed from above. Abdomen round and swollen, wider than the thorax but seeming as if cut off short, the posterior extremity being turned under; there are six segments on the abdomen. *Colour* dark brown, almost black, on the thorax, with short yellow hairs; abdomen dark brown, with a yellow band marking each segment; head black; wings hyaline; halteres yellow. The *winglets* are very large and scale-like. *Eyes* very large, compound, occupying all the upper part of the head, but not highly convex (fig. 2). *Antennæ* (fig. 3) inserted in front, between the eyes; two-jointed, both joints very short; the style is very long, inflated near the base, narrow in the shaft and slightly dilated at the tip, where there are two short bristles. *Proboscis* (fig. 2) very short, almost obsolete, conical; placed so much beneath the down-turned head as to be extremely difficult to detect. *Feet* (fig. 5) long and slender; tarsus five-jointed; claw double (fig. 6) with three pulvilli. *Wings* (fig. 4) with brown costal and sub-costal veins; discoidal cell open; cubital cell large; the postical vein appears to have a branch almost if not quite disconnected. *Length* of the body, in the usual position, nearly $\frac{1}{8}$ inch.

The eggs of this insect are very small, sooty black, truncato-ovate (fig. 7); as stated above, they are laid in such numbers as to cover a twig with a black coating.

The larvæ are very minute, about $\frac{1}{80}$ inch long; dark-grey or brown in colour; elongated, narrow, tapering at both ends, with twelve distinct segments, of which the fourth from the head is the widest; on each segment is a row of short fine hairs (fig. 8). They are in constant motion, wriggling: the mode of progression forwards is shown in fig. 9. The head is pointed and terminates in two very small hooks, with a pad or pulvillus (figs. 10 and 11). The posterior extremity is also acute, ending in three very minute points with, on each side, a thin curved appendage (fig. 12). The spiracles are only two, very minute circular orifices, situated on the last segment but one (fig. 12).

Both Mr. Hudson and I tried without success to procure the pupæ. The larva of a fly not far removed from *Henops* (*Clitellaria*) is said to take more than two years before undergoing its transformation.

In consideration of the fact that the larvæ of the whole family of *Acroceridæ* have not hitherto been known, and that the descriptions of the various genera are but fragmentary, the above account of *Henops brunneus* may be of interest. The larva would seem to be perhaps more similar to those of *Cecidomyia* than to any others of the order, though the perfect fly is quite different.

EXPLANATION OF PLATE X.

Fig. 1.	*Henops brunneus,*	flies on a twig, about natural size.	
Fig. 2.	„	head of perfect fly, viewed from beneath	× 15
Fig. 3.	„	antennæ of „	× 120
Fig. 4.	„	wing of „	× 6
Fig. 5.	„	foot of „	× 15
Fig. 6.	„	claws and pulvilli of perfect fly	× 50
Fig. 7.	„	eggs	× 15
Fig. 8.	„	larva	× 90
Fig. 9.	„	larva, to show mode of progression.	
Fig. 10.	„	head of larva, viewed sideways	× 100
Fig. 11.	„	„ viewed from above	× 100
Fig. 12.	„	last two segments of larva, showing spiracles	× 100

ART. XVII.—*On new Species of* Araneidea.

By A. T. URQUHART.

[*Read before the Auckland Institute, 31st October,* 1887.]

Plate XI.

Fam. THERIDIIDÆ.

Genus **Linyphia**, Latr.

Linyphia rufocephala, sp. nov. Plate XI., fig. 1.

Female.—Ceph. th., long, 2·5; broad, 2. Abd., long, 4; broad, 2·3. Legs, 4, 1, 2, 3. Length of 1st pair, 8·8 mm.

Cephalothorax red-mahogany colour; oval, clathrate, slightly compressed forwards; lateral index equals breadth of ocular area; thoracic indentation longitudinal, deep; radial and caput striæ defined by dark streaks; profile contour rises with a low curve, at an angle of 30°, pars cephalica moderately arched; *clypeus* vertical, convex, height rather exceeds depth of facial space.

Posterior row of *eyes* sensibly procurved, central pair separated by about their diameter from hind-laterals, half that interval from each other; anterior row sensibly recurved, median pair much the smallest of eight, their radius apart, rather more than their space from hind-centrals, and fore-laterals; side eyes slightly exceed posterior median pair in size, have their pearl-grey lustre; seated obliquely on moderate tubercular eminences; contiguous.

Legs yellow-brown; broad, faint annuli; moderately long hairs; few spines on tibiæ of 1–2, and tibiæ and metatarsi of 3 (three terminal joints of 4 were missing). Superior tarsal claws—1st pair, about 16 short, close teeth; inferior claw, 2 teeth.

Palpi slender, length 3 mm.; yellow-brown; rather strong spines on radial and digital joints; palpal claw long, slender, rather straight, 7 teeth, 6 small, close.

Falces light red-mahogany; tumid near base in front, directed somewhat forwards and outwards, stouter than femora of 1st pair of legs; fang strong, double row of teeth, inner short; outer row, 6 strong teeth, 4 central longest.

Maxillæ linear, apex pointed, inclined towards *labium*, which is short, twice as broad as long, apex everted; organs chocolate-brown, apices brownish-yellow.

Sternum cordate, brownish-yellow.

Abdomen oviform, rather sparsely clothed with moderately strong hairs; pale stone-grey; two, somewhat faint, blackish bands, with three or four long, tapering, dentate projections on either side, converge from base to spinners, enclosing a linear-oval space, spotted with a few dark flecks; from the blackish ventral surface several not clearly defined dark streaks curve upwards and backwards on lateral margins. *Corpus vulvæ* large, transversely wrinkled, convex above, broader than long, inferior side rather the widest, centrally produced into a pale-yellow ladle-like scape; lateral margins of corpus project forwards, curve inwards towards the amber-coloured bole-like apex of scapus, with which they form a nearly even line. Corpus vulvæ pale greenish-yellow; pale-yellow streak, in line with scapus, intersects two broad, brown, longitudinal bands.

Male.—Ceph. th., long, 2·8; broad, 1·7. Abd., long, 8; broad, 1·2. Legs, 1–4, 2, 8 = 7, 6, 5·2 mm.

Cephalothorax red-mahogany colour; clathrate; oval, slightly compressed forwards; caput convex, roundly truncated; thoracic indentation large, ovate; caput and radial striæ fairly well-defined, but shallow; profile contour rises at an angle of about 40°, slightly depressed across indentation, pars cephalica arched; *clypeus* slightly convex, height almost exceeds depth of facial space.

Posterior row of *eyes* sensibly procurved, median pair their radius from each other, rather more than their breadth from laterals next to them; anterior row sensibly recurved, centrals small, more than one third their diameter apart, about their space from posterior-centrals, three-fourths their space from fore-laterals; side eyes placed obliquely on strong tubercles, contiguous.

Legs moderately long and strong, brownish-yellow; annuli, mostly, rather faint; armature, fine, erect black hairs, bristles on genual joints, 1st pair femora, slender spine on inner side; tibiæ have three long bristles—two above, one beneath; 2nd pair, single spine on tibiæ; tibial joints of 8–4 have, respectively, 4–8; metatarsi two long, and circle of four short spines; superior tarsal claws,—1st pair, 10 close, comb teeth, increasing in length and strength; inferior claw short, free, and directed outwards, 2 stout teeth, basal shortest.

Palpi, humeral joint one-third longer than cubital and radial joint together, colour of legs; cubital joint concolorous, nearly equals radial in length, rather dilated in centre, projects from apex, a strongish bristle; radial joint light mahogany colour, furnished with numerous long bristle-like black hairs; nearly one-third longer than broad, cyathiform, base rather slender; digital joint about equal to humeral in length; lamina bulbi long, tapering, breadth rather exceeds length at radial joint, similar to latter article in colour and armature, disconnected almost its entire length from the genital bulb; on inner side of clava a long, slender, apophysis curves upwards and backwards; on outer side, projecting from margin of radial joint, is a lake-brown, broad, membranous process, directed downwards and forwards, concave on outer side; bulb yellow-brown, less than half length of lamina; view from superior side, somewhat campanulate, forepart concave, margin at concavity produced on lower side into a short spur, directed downwards; extending over most of the outer face of bulb is a large, oval, yellowish membrane, with lake-coloured tumid margins; an olive-green, semi-transparent, involute, pointed membrane projects forwards nearly to apex of the lamina bulbi: between this membrane and the concave surface of the latter is a long dark membranous apophysis, directed forwards, apex pointed, curved downwards.

Falces red-mahogany colour; transversely wrinkled; outwardly armed with a few rows of short, dark papillæ; tumid at base, on outer side, tapering, apices directed outwards, fangs long, double row of teeth, two central long.

Maxillæ strong, apices dilated, rounded, and somewhat obtusely pointed, curve over lip; base dark-brown, graduating to a bright red-mahogany. *Labium* rather broader than long, nearly semicircular, about half length of maxillæ, margin strongly everted; red-mahogany colour, base dark-chocolate colour.

Sternum ovate, lacunose, chocolate-brown.

Abdomen oval; stone-grey; curved bands on dorsal field are of a darker hue, and the dentation less defined than those of females: the genital aperture is covered by a rather prominent, semi-oval, transversely-wrinkled hood.

This species was contained in a collection kindly sent me by *P. Goyen, Esq.*, from Dunedin.

Linyphia lagenifera, sp. nov. Plate XI., fig. 4.

Female.—Ceph. th., long, 3; broad, 2·2. Abd., long, 6; broad, 3·2. Legs, 1, 2, 4, 3 = 21, 14, 11, 7 mm.

Cephalothorax yellow-brown; broad median band and marginal zone brown; hairs sparse, light; oval, rugulose; caput roundly truncated, rather depressed; lateral index equal to space from a fore-lateral eye to the hind-central furthest from it; median fovea circular; normal grooves faint, brown; contour of profile rises from thoracic junction at an angle of about 45°, slopes moderately forward across pars cephalica; *clypeus* in height about three-fourths depth of ocular area.

Posterior row of *eyes* sensibly recurved, nearly straight, equidistant; median pair separated by a space about equal to their diameter and rather more than that interval from fore-centrals, which are slightly further apart than former pair; anterior row recurved, centrals rather further from each other than they are from fore-laterals; side eyes seated obliquely on strong, cup-shaped tubercles, separated by a space nearly equal to their diameter.

Legs yellow-brown, broad chestnut-brown annulations; armature moderately long hairs; long, slender, black spines on femoral, genual, tibial, and metatarsal joints; 1–2 pair stoutest, about equal in strength. Superior tarsal claws—1st pair, 15 short, nearly even teeth; inferior claw, 2 close teeth.

Palpi resemble legs in colour and armature; palpal claw moderately curved, slender, 9 teeth.

Falces strong, tapering, project forwards at base in front, directed moderately outwards; chocolate-brown.

Maxillæ somewhat spathulate, obtusely pointed, inclined towards lip, which is semicircular; organs dark-brown, apices lighter shade.

Sternum cordate, brownish, well-developed, somewhat conical, eminences opposite coxæ of 3rd pair of legs.

Abdomen oblong-oval, moderately convex above; rather sparsely clothed with short yellowish hairs; olive-brown, mottled with yellow-brown flecks; dorsal mark similar tint, lageniform, extends three-fourths length of abdomen from base, margined and marked with dark-brown; nearly in centre of basal part—which is large, and nearly circular—is a small yellowish cross; beyond the neck-like posterior end are two dark angular marks, apices directed forwards; ventral surface yellowish. *Vulva* brownish, moderately convex eminence, concave within, centrally produced into a broad, rounded scapus, directed backwards.

Otago, *P. Goyen.*

Genus **Theridium**, Walck.

Theridium nigrofolium, sp. n. Plate XI., fig. 3.

Female.—Ceph. th., long, 1·5; broad, 1; Abd., long, 2·8; broad, 2. Legs, 1, 4, 2, 3 – 7, 6·8, 5·2, 3·5 mm.

Pars thoracica light-brown, somewhat streaked; pars cephalica and marginal zone dark-brown; oval, rugulose, slightly compressed forwards, ocular eminence prominent, transverse groove behind first row of eyes; caput strongly convex, groove well-marked; thoracic fovea oval, radial striæ rather faint; profile line represents a rather abrupt curve posteriorly, slight arch across caput; *clypeus* directed forward; in height rather less than depth of facial space.

Posterior row of *eyes* moderately procurved; centrals exceed laterals in size by about one-fourth, nearly their diameter apart, about twice that space from anterior pair, rather more than former interval from side-eyes; anterior row strongly recurved, centrals prominent, perceptibly smaller than posterior pair, rather further from each other than are the hind-median eyes; laterals have the pearl-grey lustre of posterior-centrals, seated obliquely on strong brownish tubercles, nearly contiguous.

Legs slender, pale brownish-yellow, annuli brown, faint above, except at articulation of joints; hairs very sparse, few bristles, chiefly on metatarsi, bristle-like hairs on penultimate and terminal joints; superior tarsal claws partially broken; inferior 1 tooth, point behind.

Palpi yellowish; few hairs; 2 strong, erect bristles on cubital joints, basal curved, shortest; palpal claw, 7 open comb teeth, increasing in length and strength.

Falces slender, vertical, nearly equal in length to three terminal joints of palpus; brownish-yellow.

Maxillæ strong, obliquely truncated on superior side, inclined towards lip; yellow-brown. *Labium* semicircular, everted, about one-third length of maxillæ; dark-brown.

Sternum broad between coxal joints of 3rd pair of legs, tapering to a point between coxæ of 4th; rugosity scale-like; olive-brown, clouded with brown.

Abdomen ovoid, crenate depression on base; integument pale olive-brown, numerous lobate flecks of a paler hue; more than three-fourths of dorsal field covered by an ovate black-brown leaf-like mark, with somewhat acute crenate margins; on posterior half are a series of yellowish-brown spots, terminating above spinners in a large, somewhat elliptical, centrally constricted mark of a similar hue; petiole black, extends to basal notch, few black dots on either side; on lateral margins are a few black flecks; two black streaks curve obliquely backwards from base of petiole; on ventral field are three dark spots, two beneath the branchial opercula, one contiguous to spinners. *Vulva* represents a transverse oval depression, margin wrinkled; projecting outwards from inferior margin are two dark-brown conical processes, separated from one another by a space equal to their basal diameter.

Port Waikato, *A.T.U.*

Theridium helvolum, sp. nov. Plate XI., fig. 2.

Female.—Ceph. th., long, 1·5; broad, 1. Abd., long, 2·5; broad, 1·8. Legs, 1, 4, 2, 3 = 10, 7·5, 6, 4·2 mm.

Cephalothorax light-brown, median band and marginal zone wide, two latter and pars cephalica mottled and streaked with dark-brown; pale radial streaks on pars thoracica have a somewhat metallic lustre; clathrate; broad-oval, moderately compressed forwards; caput not very convex, lateral index rather less than space from a hind-lateral eye to the hind-central furthest from it; median fovea somewhat oval, deep; normal grooves, faint; profile contour represents a slight arch across caput, the posterior curve somewhat abrupt and uneven; *clypeus* directed forwards, height equal to about two-thirds of facial space.

Anterior row of *eyes* recurved; posterior row moderately procurved, centrals nearly one-third larger than laterals, separated from one another by a space slightly exceeding their diameter, rather more than that interval from lateral eyes next to them and anterior median pair, with which they nearly form a square; fore-centrals placed on a moderate prominence, nearly equal laterals in size, rather further from each other than they are from latter eyes; laterals seated obliquely, close together, on moderate tubercles, have the pearl-grey lustre of hind-median eyes.

Legs moderately long and slender, dark straw-colour, numerous dark-brown spots; genua and annuli at articulation of joints red-mahogany colour, strong black hairs on inferior side of metatarsi and tarsi. Superior tarsal claws—1st pair, 5 teeth, 8 terminal strong; inferior claw, 2 small teeth.

Palpi slender, about equal to cephalothorax in length, resemble legs in colour; palpal claw similar to tarsal claw, 5 teeth.

Falces conical, vertical, about equal to humeral joint of palpus in length; dark straw-colour, mottled with dark-brown.

Maxillæ more than twice as long as broad, obliquely pointed, inclined towards *labium*, which is broader than long, nearly semicircular, organs yellowish, olive tinge.

Sternum broad-cordate; dull olive-yellow, spotted and margined with chestnut-brown.

Abdomen oviform, pointed posteriorly; light stone-colour; folium large, not well-defined, shade darker than ground-colour, flecked with black, few red-lake spots, latter numerous on posterior half; longitudinal band, or midrib, creamy-colour; on lateral margins broad bands, with lake-coloured spots, extend from base to the reddish portion of dorsal folium; beneath these bands and on ventral surface the integnment is spotted with black.

Vulva, viewed from above, somewhat reniform, projects forwards over the rima genitalis, blackish; red-chestnut, fan-shaped mark above; margins on inferior side very tumid, cleft by a broad longitudinal groove, on either side of groove are large circular fovea.

Var. *a*, nov.

Cephalothorax and *legs* of a lighter hue than type form; spots and annulations on legs less defined. *Abdomen* pale stone-colour, folium faintly defined, posterior margins picked out with black-brown, mid-rib and oblique marks creamy colour, yellowish-red spots.

Three specimens were captured on *Leptospermum*, Port Waikato, *A.T.U.*

Theridium truncatum, sp. nov. Plate XI., fig. 5.

Female.—Ceph. th., long, 1·9; broad, 1. Abd., long, 3 broad, 2. Legs, 4, 1, 2, 3 = 6, 5·9, 5, 4·2 mm.

Cephalothorax brown, marginal zone dark-brown; oval, rugulose, moderately compressed forwards; ocular prominence moderate, lateral index rather exceeds space from a fore-lateral eye to the anterior-central furthest from it; thoracic indentation deep, transverse, radial and caput striæ well-marked; profile line slightly arched across pars thoracica, rising a little to posterior row of eyes; *clypeus* projects a little forwards, sensibly convex, height nearly equals depth of ocular area.

Posterior row of *eyes* sensibly recurved, median pair three-fourths their diameter from each other, rather more than that interval from fore-centrals, their breadth and a half from hind-laterals; anterior row recurved, centrals smallest of eight, separated by their diameter and a half, rather less than that interval from side-eyes next to them; laterals have the pearly lustre of hind-median pair, seated obliquely on rather strong, dark-brown tubercles, one-fourth their diameter apart.

Legs moderately strong; brownish-yellow; armature, erect black hairs, few slender bristles; superior tarsal claws—1st pair, 10 comb teeth; inferior claw fine, 2 points.

Palpi slender, shorter than cephalothorax, brownish-yellow, digital joint brown; dark hairs; palpal claw, 6 teeth.

Falces mahogany-brown; vertical, somewhat linear, about one-third longer than clypeus.

Maxillæ long, tapering, slightly rounded on superior side inclined over lip; yellow-brown, greenish tinge. *Labium* oval, half as long as maxillæ; dark-brown.

Sternum cordate, clathrate, light-brown.

Abdomen oviform, somewhat aplanate above, projects over base of cephalothorax; posterior end dips abruptly to spinners; sparely clothed with rather coarse light hairs; dorsal field light yellow-brown, two broad chocolate-brown sinuate bands—posterior fourth, acutely dentate—extend from base to spinners; ventral surface and lateral margins chocolate-brown; between the dorsal bands and sinuated lateral margins are broad light streaks.

Vulva yellowish; low, conical, almost circular, wrinkled eminence, slightly indented on inferior side. (Possibly an immature specimen.)

Otago, *P. Goyen.*

Theridium exornatum, sp. nov.

Female.—Ceph. th., long, 1·5; broad, 1. Abd., long, 3; broad, 2·8. Legs, 1, 2–4, 3 = 9·8, 7, 4 mm.

Cephalothorax light-brown, reddish hue about occiput and clypeus; two median streaks, and marginal zone dark-brown;

somewhat clathrate; oval, compressed forwards; caput rather prominently convex, lateral index nearly equals half breadth of caput; fovea on pars thoracica large, oval; normal grooves fairly marked; profile contour represents a somewhat even arch, posterior dip most abrupt; *clypeus* directed a little forwards, height nearly equals depth of ocular area.

Eyes about equal in size, four central nearly form a square, posterior side shortest; hind row slightly procurved; median pair encircled by dark rings, separated by their diameter, space between them and side-eyes next to them slightly exceeds latter interval; anterior row recurved, median pair rather further from each other than they are from fore-laterals; side-eyes seated obliquely on dark tubercles, nearly contiguous.

Legs moderately slender, 2–4 about equal in length; light yellow-brown, brown annulations, chiefly at articulation of joints; 1st pair speckled with olive-green; armature darkish hairs, erect bristle on tibiæ; superior tarsal claws—1st pair, well-curved, 7 teeth; inferior claw rather strong, 2 teeth.

Palpi moderately long, yellowish-brown, dark hairs; palpal claw rather weak, 5 teeth.

Falces vertical, nearly equal to femora of 1st pair of legs in thickness; yellow-brown.

Maxillæ long, somewhat linear, rounded on superior side, curve inwards; *lip* oval, half length of maxillæ; organs yellowish.

Sternum, forepart broad, base attenuated; somewhat areolate; yellow-brown, margins dark.

Abdomen ovoid; yellowish-brown, base and lateral margins flecked with numerous creamy-coloured spots; folium runcinate, deeper hue, margins black, midrib wide, creamy colour, black spot near centre; very sparsely clothed with fine hairs. *Vulva* glossy brown-black, prominent, projects outwards, nearly circular, superior side concave, margins broad, introflexed, deeply notched in front.

Port Waikato, *A.T.U.*

Fam. EPEIRIDÆ.

Genus **Epeira**, Walck.

Epeira viridicans, sp. nov.

Female.—Ceph. th., long, 3·6; broad, 2·6; facial index, 1. Abd., long, 6; broad. 4·5. Legs, 1, 2, 4, 3 = 14, 13, 11·5, 7·3 mm.

Cephalothorax greenish straw-colour, rather faintly mottled with pea-green; hairs sparse, whitish; oval, compressed forwards, rather depressed, equal in length to the femoral joint of a leg of 4th pair; caput roundly truncated, ocular eminence low; lateral index equals space between anterior-lateral eyes;

thoracic fovea somewhat oval, rather deep; caput and radial striæ moderately defined; profile contour rises at an angle of about 80°, slopes moderately forwards across pars cephalica; *clypeus* in height equals radius of a fore-central eye.

Eyes have a lake-brown tinge, encircled by rings of a similar hue; fore and hind row—somewhat angular—recurved; posterior-centrals separated by an interval nearly equal to their diameter, nearly their space and a-half from hind-laterals; anterior-centrals rather larger and darker than posterior median eyes, interval between them equal to about twice that of the latter pair, rather further from one another than they are from hind-centrals; lateral eyes seated obliquely on separate and moderately prominent tubercles, one-third their diameter apart.

Legs moderately strong; straw-colour, slightly suffused with pea-green; metatarsi and tarsi brownish; armature, light hairs, sparse; spines yellow-brown; moderately numerous, but irregular, on tibiæ and metatarsi of 1st pair, tibial spines less than diameter of article in length; superior tarsal claws—1st pair, inner 9, outer 12 comb teeth; inferior claw 2 small teeth.

Palpi equal in length genual and tibial joints of a leg of 4th pair; straw-colour; hairs sparse, whitish; spines numerous; palpal claw 9 teeth.

Falces clear, pale straw-colour, fangs and teeth lake-brown; conical, vertical, project forwards at base, in thickness about equal to femora of 4th pair; teeth, inner row 8; outer 8 small, 2 large.

Maxillæ rather longer than broad, obliquely pointed, inclined towards *labium*, which is rather broader than long, somewhat pointed, everted; organs straw-colour.

Sternum pea-green, interrupted yellow median line; few hairs, spine on forepart; cordate; eminences.

Abdomen oviform, sensibly convex above; on basal end, which is pointed, are three moderately-defined impressed spots forming a triangle, whose apex is directed backwards; the four central impressed spots are well marked and form a trapezoid; sparsely clothed with very short, light hairs; yellow, suffused with pea-green; series of fine green lines extend from spinners, which are moderately long, light-brown, to posterior pair of impressed spots; lateral margins deeper green, finely wrinkled; ventral surface yellowish; greenish, yellow-margined, shield-shaped mark extends from spinners to branchial opercula, which are light-brown. *Corpus vulvæ* semicircular, transversely wrinkled, moderately prominent, centrally depressed, margins tumid; scapus bright, deep, straw-colour, directed backwards, broad, rather more than three times as long as wide, transversely wrinkled, apex calceolate; projecting laterally from about centre of scapus are broad-oval, wing-like, wrinkled processes, extremities brownish, tumid; beneath them, viewed from front, are rather prominent blackish fovea. The vulva of *E. viridicans* resembles that of *E. verutum*, but differs somewhat in the form of the wing-like projections and the deeper and rather conical form of the calceolate apex of the scapus.

Taken on furze, single example. Te Karaka, *A.T.U.*

Epeira mulleola, sp. nov. Plate XI., fig. 6.

Female.—Ceph. th., long, 5·5; broad, 4·5; facial index, 2·5. Abd., long, 9·5; broad, 8·5. Legs, 1, 2, 4, 3 = 19, 17, 14·5, 10 mm.

Cephalothorax reddish-brown; hairs yellowish, sparse; nearly equal in length to genual and tibial joints of a leg of 4th pair, depressed, sides rounded, moderately compressed forwards, ocular and mammiform eminences fairly prominent, lateral index nearly equals space between a fore-lateral and the fore-central eye furthest from it; median indentation transverse, radial and caput striæ moderately marked; profile contour represents a low arch, rising slightly at occiput; height of *clypeus* equal to about two-thirds of depth of facial space.

Fore and hind rows of *eyes* moderately recurved, curvature of posterior nearly equals that of anterior row; posterior-centrals separated by an interval equal to about their diameter and a half, twice their space from hind-laterals; anterior median pair about one-fourth larger than posterior-centrals, rather further from one another than they are from the latter pair, a space which slightly exceeds their diameter; lateral eyes seated obliquely on moderate tubercles, anterior eye rather the largest, more than its radius from posterior eye.

Legs yellow-brown, brownish annulations on tibial, metatarsal, and tarsal joints; femora of 1, 2, 4, lake-brown; 1–2 rather stout; armature, yellowish hairs, short (less than diameter of tibia) yellow spines, base dark; double row of 6 beneath tibiæ and metatarsi; superior tarsal claws—1st pair, 9 teeth; inferior claw, 2 strong close teeth.

Falces yellow-brown; short, conical, vertical, project at base in front, nearly as thick as femoral joint of 1st pair of legs.

Maxillæ about as broad as long, somewhat pointed, inclined towards *lip*, which is rather broader than long, moderately pointed; organs chocolate-brown, apices light.

Sternum cordate, eminences opposite coxæ; chocolate-brown.

Abdomen broad-oviform, depressed above, tubercles stout, short; anterior pair project outwards; posterior tubercles—transverse row of about equal length, central tubercle much the stoutest; tubercle of second row exceeds former in size; tubercle of third row small; sparsely clothed with pale short hairs; yellow-brown, flecked with dark-brown; folium trifid, creamy-white, covers dorsal field, on median line are two brown marks, largest elongate, in centre of the four central impressed spots, which are well-defined, form a trapezoid; smallest mark between hind pair of impressed spots; series of oblique, dark-brown bands on lateral margins. On ventral surface is a dark-green, transversely wrinkled, shield-shaped mark; two large creamy spots beneath branchial opercula are prolonged into narrow bands along its lateral margins; two smaller spots of similar hue above spinners. Corpus of *vulva* cucullate, transversely wrinkled; margins, which are very tumid near scape, encircle chocolate-brown fovea beneath hood; corpus vulvæ centrally produced into a broad-oval scape, about as wide as long, its beaded margins are about one-half the maximum breadth of the corpus margin; yellow amber-coloured vermiform process at apex of scapus rather exceeds it in length.

Whangarei, *T. Broun;* Te Karaka, *A.T.U.*

Epeira helveo-guttata, sp. nov.

Female.—Ceph. th., long, 4; broad, 4; facial index, 2. Abd., long, 7; broad, 7. Legs, 1, 2, 4, 3 = 15, 14, 12·2, 8 mm.

Cephalothorax light chocolate-brown, caput palest; clothed, chiefly on margins, with yellowish hairs; equal in length to genual and tibial joints of a leg of 4th pair; sides rounded, moderately compressed forwards; caput depressed, lateral index about equal to space between a hind-lateral and hind-central eye next to it; ocular prominence, and mammiform eminences, moderately developed; thoracic indentation somewhat linear-oval, transverse; normal grooves not well-marked; *clypeus* in height equal to two-thirds of depth of eye-area.

Fore and hind row of *eyes* slightly, and somewhat evenly, recurved; four central eyes nearly form a square, anterior side being rather the widest; fore pair perceptably the largest, separated from one another by their diameter and a quarter, rather less than that interval from posterior-centrals, which are nearly twice their space from hind-laterals; side-eyes placed obliquely on low tubercles, about three-fourths their diameter apart.

Legs moderately stout; femora of 1–2, lake-coloured, of 3–4, colour of cephalothorax, other joints yellow-brown, light-brown annulations; longitudinal grooves on tibial joints rather faint; armature short light hairs; spines yellowish; tibial spines rather less than diameter of article in length; double row of 6 beneath tibiæ of 1–2; beneath metatarsi, outer row 5 spines, inner 6; superior tarsal claws—1st pair, 9 teeth; inferior claw 2 close, even teeth.

Palpi 4·5 mm. in length; armature and colour of legs; palpal claw 7 teeth.

Falces light-brown, vertical, conical, project at base in front, as thick as femora of a leg of 1st pair.

Maxillæ nearly as broad as long, pointed, inclined towards *labium*, which is rather broader than long, pointed, everted; base of organs chocolate-brown, apices pale.

Sternum cordate, moderately broad; brown-black; whitish hairs.

Abdomen oviform, rather depressed above, anterior tubercles, short, conical; first row of posterior tubercles of about equal size, slightly longer than anterior pair; tubercles of second and third rows moderate; ground-colour dark-brown; folium darker, margins undulating, covered with more or less connected lobed flecks of a yellow-brown colour, spotted with lake-brown; on base and in centre of four impressed spots, hind pair deep, are dark-brown marks of irregular form; lateral margins thickly spotted with flecks, similar but smaller than dorsal; olive-brown yellow margined shield-shaped mark on ventral surface; yellow-brown, pyriform marks beneath branchial opercula; spots of similar hue above spinners. *Vulva* yellow-brown; corpus vulvæ cucullate, lateral margins nearly equal centre in depth, transversely wrinkled; fore-margin beaded, curves within, enclosing two chocolate-brown fovea; corpus vulvæ centrally produced into a somewhat elliptical process, fore-half of margin rather more tumid than margin of hood, and of a dark-brown colour; amber-coloured, vermiform scape at apex of process equals it in length.

Captured in the Tikitapu Bush, near Lake Taraweră, February, 1887, *A.T.U.*

Epeira tri-tuberculata, sp. nov. Plate XI., fig. 7, 8.

Male.—Ceph. th., long, 2·9; broad, 2. Abd., long, 2·9; broad, 2·5. Legs, 1, 2, 4, 3 = 12, 10, 9, 7 mm.

Cephalothorax olive-brown, shading off to a somewhat flesh-coloured light brown about caput; two broad bands of a similar hue extend from base of latter to thoracic junction, enclosing a brown linear-oval space; lighter parts clothed with white hairs; pars thoracica nearly circular, median fovea oval, normal grooves slight; pars cephalica prominent in front, transverse indentation near centre.

Four central *eyes* on a strong eminence, hind pair smallest, separated from each other by about their diameter; fore pair rather more than their breadth apart, about that interval from posterior-centrals; laterals placed obliquely on rather strong tubercles, less than their radius apart.

Legs moderately slender, 2–4 nearly equal in length; pellucid, pale stone-colour, spotted, and more or less annulated with chocolate-brown: armature, fine light hairs, numerous, rather short, erect, black spines; tibia of 2nd pair strong, produced at fore-end, on inner side, into stout, somewhat conical, tubercles, projecting strong curved spines. Superior tarsal claws—1st pair, 13 comb teeth.

Palpi straw-colour; humeral joint rather exceeds cubital and radial in length; cubital projects two long bristles from apex; radial joint dilated on outer side, furnished with a black bristle; digital joint oval; lamina bulbi hairy, base produced into a stout, dark lake-coloured apophysis; in centre of bulb, on outer side, is a stout, long, blackish apophysis, directed downwards, curving backwards, concave on superior side; bulb terminates with three membranous projections, apices of two upper processes spine-like, outer spine strongest; inferior process directed downwards.

Abdomen resembles female's; depressed above, base rounded, tapers moderately to spinners; anterior tubercular eminences, prominent, pointed, project somewhat upwards and outwards; integument rich mahogany-brown, moderately clothed with orange, white, and somewhat bristle-like erect black hairs; fore tubercles connected by a whitish, slightly undulating band; directed backwards from centre of band are two short oblique bars, of similar hue; on fore part of a broad, dark-brown, longitudinal band on base of abdomen, are two whitish spots; folium tapers from fore pair to posterior tubercle, dark mahogany-brown, white acute-crenate margins.

This species appears to be rare; the female was described in "Trans. N.Z. Inst." vol. xix., p. 78.

Te Karaka, *A.T.U.*

Epeira orientalis.

All the specimens examined when describing this species ("Trans. N.Z. Inst.," vol. xix., p. 79.) proved to be immature; in mature examples a black, somewhat oval, rather pointed, deep margined lip, about half as broad as long, one-fourth longer than breadth of vulva, projects backwards from beneath the semi-pendulous process of the corpus vulvæ.

Fam. ATTIDÆ.

Genus **Marpissa**, C. Koch.

Marpissa leucophæum, sp. nov. Plate XI., fig. 10, 11.

Female.—Ceph. th., long, 3·3; broad, 2.9. Abd., long, 4; broad, 2·1. Legs, 1–4, 2, 3=5·5, 5, 4·8 mm.

Cephalothorax yellow-mahogany, dark-brown spots contiguous to four lateral eyes; sparse patches of light-yellow hairs on median line and marginal zone, strong fringe across frontal margin; pars thoracica moderately dilated, one-third longer than pars cephalica, latter aplanate, limited posteriorly by a somewhat oval fovea; profile line rises with a slight arch from thoracic junction, slopes slightly forwards from second row of eyes; height of *clypeus* less than radius of an anterior lateral eye.

Anterior row of *eyes* slightly recurved, laterals are about their radius from centrals, which are rather closer to one another, and much the largest; posterior pair are slightly further apart and perceptibly larger than fore-laterals, are placed on dark-brown tubercular eminences; eye-area rather less than one-fourth broader than long.

Legs, first pair rather stout, yellowish, tinged with reddish-brown; hind pairs deep straw-colour; armature sparse light hairs, black spines, short and curved on femoral joints; femora of 1st dilated and compressed; genua and tibiæ cylindrical, rather shorter than cephalothorax, latter articles rather the longest; metatarsi and tarsi shorter and much slighter than former articles; 1 spine on inner and under side of genua; beneath tibiæ 3–4; metatarsi 2–2; spines on tibial and metatarsal joints of 2, 3–4 fewer and less regular; tarsal claws—1st pair, outer 1 strong tooth; inner claw, about 14 close fine teeth; claw-tuft strong; hairs linear, longer than claws.

Palpi straw-colour; whitish hairs.

Falces sensibly directed forwards, rather longer than three terminal joints of palpus, stouter than femora of 1st pair, transversely rugose; dark lake-chocolate colour.

Maxillæ dilated at extremity, rounded; *labium* oval, apex truncated, furnished with coarse hairs; organs brownish.

Sternum oval, nearly twice as long as broad; coxæ longer than broad; coxal joints of 1st pair strongest, about breadth of lip apart; yellowish.

Abdomen elongated, pointed at spinners, moderately convex above; hairs sparse, pale-yellowish; pale fulvous; dorsal mark linear-ovate, cinereous, enclosing a series of fulvous oblique bars. *Vulva* yellowish red-chestnut; somewhat oval; two deep, circular fovea, divided by a longitudinal septum; posterior margins tumid, with an apparently natural depression, black spot in centre.

Male.—Ceph. th., long, 3·3; broad, 2·9. Abd., long, 4; broad, 2·1. Legs, 1, 4, 2, 3 = 7·3, 7, 6·5, 6 mm.

Cephalothorax does not differ essentially in form or colour from female's.

Legs differ from female's in their actual and relative lengths, but not in colour, or spine-armature.

Palpi yellowish; hairs sparse; humeral joint nearly equals three terminal articles in length, projects a short curved spine, near its articulation with cubital joint, which is rather strong, broadest at fore-end, projects a fine bristle; radial joint less than half length of cubital, produced on outer side into a rather short, pointed, black apophysis; clava oval; lamina bulbi moderately hairy; basal ⅔ of bulb convex, yellowish, fore-third depressed, concave, pointed, reddish colour.

Abdomen in form, colouration, and pattern resembles female.

Port Waikato, *A.T.U.*

Marpissa arenaria, sp. nov.

Female.—Ceph. th., long, 2; broad, 1.—Abd., long, 2·8; broad, 1·5.—Legs, 4, 1, 2, 3.

Cephalothorax light olive-brown, two brown median streaks terminate at black spots, in line with second row of eyes; margins of pars cephalica fairly clothed with adpressed white hairs, few erect black; from median indentation two bands of white hairs curve obliquely across pars thoracica to marginal zone, which is furnished with similar hairs; sides moderately dilated, caput aplanate; profile line rises rather abruptly from thoracic junction, slight slope across occiput; *clypeus* furnished with rather strong white hairs, directed towards each other; slopes sensibly inwards, height less than radius of a fore-central eye.

Anterior row of *eyes* sensibly recurved; irides pale-yellow hairs; eyes nearly equidistant, space between a central and lateral nearly equal to diameter of latter; posterior eyes not on eminences; eye-area one-fourth broader than long.

Legs clear brownish straw-colour; sparse white hairs, few erect black bristles; legs moderately long and strong, do not differ greatly in length or strength; genual and tibial joints about equal in length; curved spines on femora; tibial and metatarsal spines of 1–2, 3–3, 2–2; few spines on 3–4; tarsal claws—1st pair, inner claw, 9 short even teeth, 1 strong terminal tooth; outer claw, 2 moderately stout teeth.

Palpi resemble legs in colour, sparse white hairs.

Falces short, stout, directed somewhat inwards; straw-colour.

Maxillæ strong, rounded and dilated at extremity; *labium* oval, less than one-half length of maxillæ; organs yellowish.

Sternum oval, yellowish.

Abdomen elongate-oviform, somewhat depressed above, projects moderately over cephalothorax; rather sparsely clothed with light-yellow and white hairs; light olive-brown, a dark-brown linear-lanceolate mark, enclosing a pale streak, furnished with white hairs, extends the length of dorsal line; this mark is bordered by a wide band of close white hairs; lateral margins somewhat clouded with brown; ventral surface paler than dorsal; spinners moderately long, yellow-brown. *Vulva* somewhat reniform, moderately concave, margins dark-brown, centrally produced on superior side into a long, vermiform process, directed backwards; margins incurved on inferior side.

I am indebted to *R. Glasson, Esq.*, for this example, which was captured on the sand-hills at Port Waikato.

Marpissa æri-hirta, sp. nov.

Female.—Ceph. th., long, 2; broad, 1·6. Abd., long, 2·5; broad, 1·3. Legs, 1–4, 2, 3 – 4·8, 4, 3·8 mm.

Cephalothorax blackish-mahogany colour; sparsely clothed with black and lanceolate copper-coloured hairs; rugulose; sides moderately dilated; pars cephalica aplanate, sides rather abrupt, projects over falces, limited posteriorly by a somewhat triangular indentation; pars thoracica one-third longer than caput; profile contour between a posterior eye and thoracic junction represents an obtuse angle, hind slope of which forms an angle of 60°, caput slopes sensibly forwards; *clypeus* very narrow. Ocular area nearly one-third broader than long; anterior row of *eyes* sensibly recurved, separated from one another by a space equal to the radius of a lateral eye; irides sparse, golden-orange hairs; posterior eyes, not on eminences, slightly exceed anterior laterals in size.

Legs moderately stout; 1st rather exceed 2nd in length and strength; mahogany-colour, suffused with brown, metatarsi and tarsi lake tinge; 2nd pair duller hue; 3–4 yellow-brown, well-defined brown annulations; armature, moderately long, black and pale-yellow hairs; 4 spines on femoral joints; fine bristle on genual; beneath tibiæ of 1–2, 3–4; metatarsi 2–2, strong spines equal article in length; tibiæ of 3–4, 4 beneath; metatarsi have, besides circle, a single spine on inner side; outer claw, 1st pair, 1 strong tooth near base; inner claw, about 12 close fine teeth, 1 strong terminal tooth; claw-tuft linear hairs.

Palpi yellow-brown, suffused with dark-brown; white hairs, coarse black; cubital joint slightly exceeds radial in length.

Falces red-mahogany; somewhat oval, nearly as broad as long, inclined forwards; transversely rugose.

Maxillæ brownish-orange, base dark; about twice as long as broad, dilated at extremity, which is rounded, more prominent on inner side. *Labium* dark-brown, light apex; conical, apex concave, less than half length of maxillæ.

Sternum oval; black-brown, few fine hairs.

Abdomen linear-oviform, somewhat aplanate above; black-brown; moderately clothed with coarse black and coppery-yellow hairs; not well-defined, somewhat angular, bare patches on dorsal line; superior and central pair of spinners straw-colour, inferior pair brown-black. Ventral surface brown-black, four converging, longitudinal, yellowish streaks. *Vulva* represents a glossy, reddish-brown, transversely rugulose, moderate eminence, in centre of which is a large circular depression, on posterior half are two oval fovea, margins prominent, divided by a broad, curved septum, somewhat attenuated posteriorly.

Te Karaka, *A.T.U.*

Attus bimaculosus. Plate XI., fig. 9.

The female was described in vol. xix., "Trans. N.Z. Inst." Owing to the description of the vulva having been inaccurate, a drawing of that organ, taken from a fresh example, captured on the summit of Ngongotaha, Rotorua, is given on Plate XI. Corpus vulvæ centrally produced into a tapering pendulous process; the concavity is only moderately depressed, of a yellowish colour; on the face is a light-brown, beaded, involute mark.

EXPLANATION OF PLATE XI.

Fig. 1. *Linyphia rufocephala*, sp. nov., vulva of female; *a*, inner view of male's palpus; *b*, outer.
Fig. 2. *Linyphia lagenifera*, sp. nov., female.
Fig. 3. *Theridium nigrofolium*, sp. nov., female.
Fig. 4. *Theridium helveolum*, sp. nov., vulva.
Fig. 5. *Theridium truncatum*, sp. nov., female, four times natural size.
Fig. 6. *Epeira mulleola*, sp. nov.
Fig. 7. *Epeira tri-tuberculata*, sp. nov., male.
Fig. 8. *Epeira tri-tuberculata*, palpus.
Fig. 9. *Attus bimaculosus*, vulva.
Fig. 10. *Marpissa leucophæum*, sp. nov., falces, maxillæ, and labium of female.
Fig. 11. *Marpissa leucophæum*, palpus of male.

ART. XVIII.—*Notes on Rats.*

BY A. REISCHEK, F.L.S.

[*Read before the Auckland Institute, 29th August*, 1887.]

THE forests of New Zealand abound with rats; especially near the ocean and in the uninhabited wilds. I have found them in the North Island, but they are far more numerous in the West Coast sounds of the South Island. I have shot rats of various colours, such as yellowish-brown, piebald, silver-grey, brownish-grey, and black. The Wanderer rats (*Mus decumanus*) are in the majority. In 1884 I made an expedition to Dusky Sound, there I traversed many miles of country over which no human being had ever been before. At the altitude of 4,000 feet I found the rats very numerous, and in the winter, when the mountains were covered with snow, I found their tracks on it. But it is in Chalky Sound, where I am at present, that they have played on me the most devilish tricks, and are more numerous than in any other place I have been. I fed them on poisoned plaster of Paris and oatmeal, trapped and shot them; but as fast as I got rid of one lot another came. They made so much noise in the hut at night that I could scarcely sleep. They ran over us in bed, knocked articles down from the shelves, gnawed the provision cases, and made a dozen or more holes all round the hut, which I filled every morning. They dug up and carried away potatoes which were planted in the garden. The bird-skins I had in a drying hut, hung on thin wires and well poisoned, but the rats climbed the rafters, jumped down on them, and spoiled several. I had skeletons hanging on a thin wire, 12 feet high and 20 feet long; for three weeks they tried in vain to walk the tight rope, and at last succeeded; then they wound their tails round the flax like an opossum, and slid down nearly 2 feet, when they gnawed the bones and spoiled the skeletons. I cut two tracks, one six miles long, from Landing Bay to Northport, and the other eight miles long up to the "Three Brothers." The first night we camped on the mountains the grass country was swarming with rats. They gnawed at our boots, though we had them with us in the tent; while we ate our supper by the fire, they came behind us and nibbled at the bones we placed for the dogs; but they amused me most by disturbing Mr. Rimmer (my companion); he sleeps so soundly that nothing wakes him, even when I fired the gun at the rats in the hut he did not hear it; but on the mountains they took a fancy for his hair, and he was awakened three times in one night by their biting it away. I should have thought they would have been afraid the first time they saw men, dogs, and fire. They are also very destructive to the birds. I have not found a single Rock Wren here, and have always noticed where the rats are numerous there are few birds. Those birds which live and breed near the ground have very little chance of preserving their species, since the rats eat their eggs and young. They destroy large birds as well as small. I had a number of Kakapos in a cage to send to Auckland, for the proposed preserve for native birds on the Little Barrier; the rats killed two and wounded others, by biting their throats and eating parts of their heads off. Nine years ago I had live Kakapos, which the Acclimatization Society in Christchurch permitted me to place in their large cages in the garden; the rats killed them, and ate the half of one away. The rats here prefer animal to vegetable food; there are plenty of *miro* and other berries on the ground, but they will not eat them. I often found in rocks, shells, birds' feathers and rats' dung, where the rats had been eating their prey. Between Landing Bay and Northport there is a large birch tree, undermined with many holes, which is the habitation of a large colony of rats. For 4 feet above the ground the bark of the tree is eaten off; round the tree there is no vegetation, and the stench is very bad. I never had in all my expeditions so hard a fight with rats as I have had in this. It has taken five months' shooting, poisoning, and trapping, before they seemed to lessen at all. Now there are only two, and they are too shrewd to go in the trap, eat poison, or give me a chance to shoot them.

ART. XIX.—*List of Fishes found round the Mokohinou Islands, their Spawning Time: and Observations regarding some of the Species.*

By F. S. SANDAGER.

[*Read before the Auckland Institute, 14th November,* 1887.]

Name.	Whether Rare or Common.	Visitors.		Spawning Time.
		Arrive	Depart.	
Oligorus gigas (a) ..	Common during the spawning season	End of May	End of August	End of May to middle of August
,, var. (or sp.) (b)				
Arripis salar (c) ..	Common	..	..	February, March, April
Scorpis hectori ("Fishes of New Zealand") (d)	Rare ..	July ..	October	From end of July to middle of October
Upeneoides vlamingii (e)	Rather rare	October	January	..
Pagrus unicolor (f) ..	Common	..	..	November and December
Chironemus georgianus (g)	Not common		..	April and May

REMARKS.

(a) Caught in from 8 to 15 fathoms during the spawning season. At other times it is not, so far as I am aware, found near the Mokohinou Islands, but abounds in from 30 to 60 fathoms some distance (about three-quarters of a mile) off.

(b) It is very easy to distinguish two distinct varieties or species, one of which is much fatter and with a larger head than the other. The Barrier Natives call the small-headed or common kind *hapuka*, and the other *maione*.

(c) Very common all the year.

(d) My first specimen was caught in July, 1884, and I observed no more till this year (1887) when others were caught in July and October. The specimens were spawning.

(e) Caught two examples with a bit of crab in 5 feet of water, but it will rarely bite. I have occasionally seen this fish in shallow water stirring up the shelly bottom with its barbels, which are darted rapidly forward with a jerky motion. This fish also applies its barbels to the bait before biting, so that the point of the hook requires to be well covered. During fine warm weather it is sometimes seen busily feeding between the tide marks.

(f) Very common all the year.

(g) Will rarely take the hook, but may be easily speared as it rests on the bottom or moves slowly amongst the Algæ upon which it feeds. It is a very fat fish, but unpalatable for food on account of its peculiar phosphorus-like odour. Its stomach is invariably crammed with large round balls of Algæ.

Name.	Whether Rare or Common.	Visitors.		Spawning Time.
		Arrive.	Depart.	
Chironemus fergussoni (a)	Common	..	..	April and May
Chilodactylus macropterus (b)	Rare ..	..	..	..
Chilodactylus spectabilis (c)	Not common	..	..	..
Chilodactylus douglassii (d)	Not common	..	..	August
Sebastes percoides (e) ..	Rare ..	..	..	..
Scorpæna oznoensis (f) ..	Common	..	.	..
Thyrsites atun (g) ..	Common	..	..	May, June, July, and part of August
T. prometheoides (h) ..	Rare ..	November	?	..
Trachurus trachurus, var. (i)	Rare (?)..	May ..	..	..

Remarks.

(a) Common on stony or boulder bottom in shallow water. Rather dry eating.

(b) I have only seen one example, but the Maoris inform me that plenty used to be found a short distance south from our landing.

(c) Occasionally caught in a few feet of water during the summer.

(d) I have caught about a dozen examples in four years. The largest measured 26 inches in total length. Like the preceding, it is occasionally seen in shallow water during the summer. The Barrier Natives know it by the name of *porae*.

(e) Rather scarce. Caught two examples in about 20 fathoms.

(f) Native name *rari*. Found in all depths from a few feet up to 60 fathoms. Flesh rather dry, but not badly flavoured.

(g) Found here all the year, but scarcest from December to March. The majority spawn during July and August. Most examples I have examined were more or less infested by parasites, one kind of which infest the gills to such an extent that half of them are frequently destroyed, leaving nothing but stumps where they formerly were; and the parasites are at times so numerous that the gills, when examined inside the mouth, appear quite alive. Another parasite (?) burrows through the flesh of the fish in all directions, and is sufficiently large not to escape the eye if a slice is examined. To judge from appearance, neither of these parasites seems to incommode the fish.

(h) I have only seen one example, which ran ashore. The fins did not exactly agree with the description of *T. prometheoides*, but were sufficiently near to cause me to refer it to this species, the lateral line being bifurcate.

(i) Took a considerable number three years ago, in May, when I saw large schools. The specimens were about the size of a herring.

Name.	Whether Rare or Common.	Visitors.		Spawning Time.
		Arrive.	Depart.	
Caranx georgianus (a) ..	Common	..	..	December to February
Seriola lalandii (b) ..	Common	..	..	..
Ditrema violacea (c) ..	Common	..	..	December to February (?)
Ditrema var. (or sp.) (d)	Common	..	..	..
Percis colias (e) ..	Not common	..	..	July and August
Trypterygium varium, sp. (?) (f)	Not common	..	..	July and August

Remarks.

(a) Found all around here in countless numbers, but does not take the hook well.

(b) Very few are caught during October, November, and December. It probably spawns about this time. The largest I have caught measured 4 feet 7½ inches in total length.

(c) This excellent fish is abundant here all the year. Its ova appear to me to be very irregularly developed and minute, and, so far, I am not quite certain regarding its spawning time. The largest specimens I have caught measure fully 15 inches, but the average fish run between 7 and 8. Countless numbers might be easily taken in nets during the summer months in shallow water, when it feeds upon small crustacea, spawn, and jelly-fish which float or swim at or near the surface, or it might be netted in a kind of bag net as it passes through some of the narrow openings between the islands, and in this way whole shoals might be secured. It often visits caves which have only a few feet of water, and I have frequently seen a whole shoal appear from or disappear into such places, and, taking up a good position above with a rod, I have caught from fifty to sixty in a couple of hours, but to do so it is necessary to use a small hook, and shell-fish or crabs for bait. During the winter, when the sea is smooth, immense numbers may be seen resting on rocky ledges as deep as the eye will penetrate, appearing as one unbroken mass of blue. Weather permitting, it may be caught any day of the year from the rocks in favourable places.

(d) Unlike the preceding it does not shoal, or feed at the surface, nor is it, as a rule, caught in shallow water. In deep water it is abundant, and may be easily caught with a hook of moderate size, baited with a bit of fish, for it bites more greedily than *D. violacea*. The largest specimen I have seen measured 14 inches in total length. I caught it during the month of July, in 18 fathoms, and it contained unripe ova. This species is bluish-grey on the back, and greyish-silvery, with a coppery tinge, on the sides. It is a more elevated form than *D. violacea*, and I know of no intermediate forms between the two fish, which differ in form, habit, and colour, although the fins of both agree, excepting a slight difference in the shape of the caudal fin.

(e) Only caught occasionally.

(f) A small species, which seems to prefer a boulder bottom.

Name.	Whether Rare or Common.	Visitors.		Spawning Time.
		Arrive.	Depart.	
Trachelochismus, two species (a)	Common	..	..	September and October
Labrichthys celidota (b)	Not common	..	..	August, September, October
Labrichthys bothryocosmus (c)	Common	..	..	August, September, October
Labrichthys psittacula, var. (d)	Common	..	..	August, September, October
Labrichthys laticlaveus (e)	Not common	..	..	August, September, October
Cossyphus unimaculatus (f)	Not common	..	..	May and June
Cymolutes sandageri (g)	Not common	November	April ..	February and March
Coridodax pullus (h) ..	Not common	..	..	July and August

REMARKS.

(a) One species is common on the boulder beach, between high and low water-marks. The other is only found *below* the ordinary low water-mark.

(b) This is the rarest of the four species. I have caught about half a dozen.

(c) I have never caught this fish in deep water. Common in shallow.

(d) A black-tailed variety, which is quite common. Unlike the preceding it is not common in very shallow water, but in from 7 fathoms and upwards it can be got almost anywhere.

(e) Caught occasionally in certain places at the north-east end of island, in from 1 to 7 fathoms.

(f) Occasionally caught in depths varying from a few feet up to 60 fathoms. It prefers crab to any other bait, and is not easily caught, unless fished for with a rod and small line. Very good eating.

(g) Occasionally seen during the summer months in a few feet of water when the tide is coming in. It bites well when the hook is baited with shellfish or crab; and should a fish drop off after being hooked it does not matter, for it will bite again and again till caught. Few fish are so persistent in this respect. During the colder months it is occasionally caught in from 8 to 15 fathoms.

(h) Far from common here, and it does not take the hook well, though it may at times be enticed to bite on a bit of crab. The mature ova of this fish are comparatively large, the grains measuring nearly $\frac{1}{25}$ inch in diameter.

Name.	Whether Rare or Common.	Visitors.		Spawning Time.
		Arrive.	Depart.	
Pseudophycis, sp. ? ([a]) ..	Not common	..	..	October, November
Scombresox forsteri ([b]) ..	Not common all the year	December	June	May
Hemirhamphus intermedius ([c])	Rare ..	March ..	?	..
Exocœtus speculiger sp. ? ([d])	Not common	March ..	?	..
Monacanthus convexirostris ([e])	Common	..	..	End of August to beginning of November
Lygæna malleus ([f]) ..	Rare ..	..	..	..
Acanthias vulgaris ([g]) ..	Common	..	..	..
Mustelus antarcticus	Not common	..	..	..

REMARKS.

([a]) Caught occasionally all the year round. It prefers a rough bottom where plenty of lurking-places are found. There appear to me to be two varieties, one of which averages from 10 to 12 inches and confines itself to shallow water (from four feet up to 6 or 7 fathoms). The other variety is sometimes 2 feet in length, and must be fished for in from 15 to 20 fathoms.

I find that specimens of *Pseudophycis* are very variable in respect of the number of rays found in their dorsal and anal fins, and scarcely any two I have examined counted alike.

([b]) This fish is not always seen here in December, but during the last four years I have observed large shoals in May and June, and secured many live specimens, as they were driven ashore by large fish. The fish seen in December are smaller than those which visit us in May and June, the largest measuring about 15 inches. Ova of this fish are very large (nearly $\frac{1}{16}$in. in diameter) and transparent when shed. This is one of the best eating fishes that is got here. Bones sometimes green. Could at times be netted in great numbers.

([c]) Rarely seen here. A few occasionally visit the island in March.

([d]) Large numbers visit the Hauraki Gulf in March, but do not come very near this island, although abundant between it and the Little Barrier.

([e]) A most troublesome fish when crab is used for bait.

([f]) I have only observed one specimen.

([g]) Abundant on sandy bottom three-fourths of a mile south from Mokohinou.

Name.	Whether Rare or Common.	Visitors.		Spawning Time.
		Arrive.	Depart.	
Scyllium, sp. ? (a) ..	Not very rare	End of May	End of August	May to (?)
Galeus canis ..	Common	..	..	..
Trygon thalassia ..	Common	..	..	..
Myliobatis aquila (b) ..	Not common	..	..	..
Bdellostoma cirrhatum (c)	Rare ..	..	..	..

REMARKS.

(a) Follows the *hapuka* in its time of arrival and departure, and it is occasionally got when fishing for *hapuka* in deep water. Excepting during the spawning time of the *hapuka* I have never caught the *Scyllium* in shallow water. It has a most disagreeable odour.

(b) Speared a large specimen two years ago. Could be got occasionally if wanted.

(c) I have only observed five or six individuals in the course of four years.

In addition to the species above enumerated as occurring here, twelve others, as yet unidentified, have been sent to Sir James Hector, Mr. T. F. Cheeseman, F.L.S., or remain in my own collection. Very little is known to me regarding the species which confine themselves to deep water, most of my captures having been made fishing from the rocks in depths varying from a couple of feet up to 15 fathoms; but I have sufficient grounds for believing that many of the deep-sea fishes visit shallow water to spawn, and in the case of some summer visitors, because the feed, such as shrimps, medusæ, different kinds of spawn, etc., is most abundant there and nearer the surface during the warmer months, the smaller fish being of course followed by predaceous species. Observations extending over a period of four years and a half convince me that visiting fishes are almost as punctual in their arrival and departure, after accomplishing their purpose, as some of the birds of passage; but few, if any, of the species enumerated leave the neighbourhood of the island, the change being merely from deep water to shallow water, or *vice versâ*, according to the season. Possibly *Scombresox forsteri*, *Trachurus trachurus* (the small variety), *Thyrsites prometheoides and Exocœtus* sp., are exceptions, for regarding these I cannot speak with any certainty, because I have never observed them during the winter.

Some species of fish are very local in their habitat, as shown by the fact that species are found in certain places round some of the Mokohinou Islands, whilst, so far as I have been able to discover, absent from others; the nature of the bottom, whether it affords suitable food and hiding-places, being no doubt a great factor in the distribution of species. One species, for instance, known to the Barrier Natives by the name of *korokoro punamu*, is only found in two of the islands, in places where overlapping boulders abound, or rocky overhanging reefs occur; the depth, however, is of no importance, for though this fish reaches a considerable size (upwards of 2 feet), I have in such places seen as many as thirty or forty in a hole, cut off from access to the sea at low water. It feeds upon the small green Algæ so common between tide-marks. It is a very shy fish, and will very rarely bite in the open water—that is, where it can be seen. As a food fish it ranks far before the *maomao* (*Ditrema violacea*), a fact which is quite recognised by the Natives, who inform me that they have never seen it elsewhere, excepting on one occasion when one was found at the Great Barrier Island. Although not a fish, it may not be out of place if I mention that crayfish (*Palinurus edwardsii*) are very abundant here. During the spawning season (from middle of May to the end of July) large numbers visit shallow water in rocky sheltered places, and the males (which do not cast their shell at the same time as the females) may be easily caught or speared. It is perhaps unnecessary to say that the casting of the shell, in the case of the females, immediately precedes the spawning.

Art. XX.—*Descriptions of new Species of New Zealand* Araneæ.

By P. Goyen.

[Read before the Otago Institute, 8th November, 1887.]

§ CITIGRADÆ.

Fam. Lycosoidæ.

Genus **Dolomedes**, Latr.

Dolomedes aquaticus, sp. nov.

Female.—Length, 18 mm.; length of cephalothorax, 8 mm. Legs 4, 2, 1, 3 (1 and 2 being almost equal) = 26, 22, 22 (about), 21 mm.

Cephalothorax chocolate brown, with a supra-marginal band of yellow extending from the posterior slope to the anterior angle of the pars cephalica: falces, maxillæ, labium, and sternum, chocolate-brown; legs and palpi, brown; abdomen above greenish-brown with two longitudinal rows of brown-margined yellow spots, at the sides greyish, and below dusky-brown with four more or less continuous longitudinal whitish stripes converging towards the anus. At the base of the dorsal surface there is a short median spathulate band of paler hue than the rest of that surface, and on each side of this band a short grey fleck. The cephalothorax and abdomen are densely covered with grey, yellow, and brown pubescence.

Cephalothorax about 1 mm. longer than broad at the broadest part, between the 2nd and 3rd pair of legs about twice as broad as at the anterior part of the caput, rounded at the sides, posterior slope very, and lateral slope moderately, steep; fovea very long, extending from half-way down the posterior declivity to the pars cephalica. Seen in profile, the pars thoracica is almost straight above, highest between the posterior row of eyes; ocular area very hairy and sloping gently from the posterior to the middle row of eyes, and thence very steeply to the anterior row; clypeus vertical and furnished with longish white hair in the middle.

Front row of *eyes* slightly curved downwards, the centrals larger than the laterals, and more distant from each other than from the laterals, the latter on small blackish tubercles; the eyes of the other rows are furnished with eyebrows, and do not differ much in size; those of the posterior row look outwards and backwards, and are placed under large black tubercles.

Falces hairy, somewhat convex near the base, and slightly diverging towards the extremities; on the posterior side of the groove 4 sub-equal rather blunt teeth, and on the anterior side at the base 2 teeth, the lower of which is large and the upper minute; claw short, and not much bent.

Maxillæ convex, narrowest at the base, and greatly increasing in breadth towards the extremities, rounded on the outside, and truncated on the inside in front, where there is a dense reddish fringe. *Labium* slightly convex, rather more than half as long as the maxillæ, sub-quadrate in outline, constricted at the base, widest near the middle, and truncated in front, where it is of a pale hue, and furnished with a fringe of coarse hair.

Sternum cordate, convex, the lateral and posterior margins wavy and densely woolly.

Abdomen ovate, slightly broader than the cephalothorax; the superior spinners the longest, and the central the shortest; the superior slender, and somewhat curved inwards; the inferior stout and of the shape of an obliquely truncated cone. In front of the latter is a small process that resembles a seventh spinner.

Legs strong; tarsi armed with a scopula, but destitute of spines; metatarsi spinous above and below; tibiæ of the 3rd and 4th pairs spinous above and below, those of the 1st and 2nd pairs below and at sides only; patellæ of 1st and 2nd pairs without spines, those of the 3rd and 4th pairs spinous above; femora spinous above only; tarsal claws 3, superior toothed and much bent, inferior toothless and bent down vertically, and completely concealed by a tuft of hair.

Palpi armed with spines above and at the sides, cubital joint with one or none, and a long bristle at the fore extremity, humeral joint with 1, 1, 1, 4. Digital joint shorter than humeral, which equals cubital and radial, the latter longer than the former; digital joint thicker at the extremities than in the middle, and bent; humeral joint turgid at the fore extremity, palpal claw much bent and furnished with 4 teeth.

Vulva brown, ovate in outline, narrowest anteriorly where it is much depressed, the depression being deeper at the sides than in the middle, and of a pale hue; the central and posterior part high, convex, and somewhat resembling a thick lip. In young mature examples there is a median band of yellow reaching from the posterior slope to the middle row of eyes, and also a yellow fleck behind each posterior eye. On each side of the abdomen and in line with the lateral bands of the cephalothorax there is a yellow band reaching from the base to about the middle.

Mas.—Legs as long as those of the female; body much shorter and slenderer; cephalothorax powerful and slightly shorter than the abdomen, the latter oblong-ovate and narrower than the former. The colours are of a paler hue and the markings more distinct than those of the female. In young examples the central area of the dorsal surface of the abdomen is bordered by a pale yellow band, extending from the base almost to the spinners. The armature of the legs is the same as that of the female's, except that all the patellæ are furnished with spines.

Palpi armed with spines above only, on the humeral joint 1, 1, 1, 4; on the cubital a slender one on the inner side and a bristle-like one at the anterior extremity, on the cubital several; humeral joint longer than cubital + radial, digital joint beak-like, convex and hairy without and concave within, and shorter than the cubital and radial joints together, the two latter not differing much in length. On the outer side of the anterior extremity of the radial joint there are 3 short blunt teeth, the middle one of which is the longest. Bulbus genitalis situated in the concavity of the beak, brown, moderately complex; a deep groove running from the base towards the front on the outer side, and a long slender spine springing from the inner side and bent round the front where there are three leaf-like processes, in one of which is concealed the extremity of the bent spine.

Hab. Otago, *P. G.*

This fine spider has been long known to the residents of the Otago goldfields, where it is plentiful in the water-races constructed for mining purposes, and on that account it has been named by the miners "the Water Spider." It is generally found on plants, stones, or pieces of wood at or near the surface of the water; and on the least alarm it runs quickly down the surface of the object to the bottom of the water, taking with it, entangled in its pubescence, large globules of air. It is able to both swim and run very rapidly on the surface of the water, but appears to be unable to get below the surface without some solid support for its feet. I have tried in vain to make it dive. When teased it makes for the nearest object, down which it runs to the bottom of the water, where it remains till all danger seems to have disappeared. Seen there in bright sunshine, its body gemmed with beautiful globules of air, it is a most handsome object. While incubating, the female retires some little distance from the water, and takes up her abode under a large stone or a piece of wood. Here she seems to remain till the young are hatched. During incubation she shows considerable aversion to water. The cocoon is globular, and is carried under the sternum, to which it is so firmly held by the palpi and strands of web from the spinners that the owner can be dispossessed of it only with great difficulty. When deprived of it she shows great concern, but is quite unable to distinguish it from that of another spider. She then runs about in the most excited manner, and seizes as many cocoons as she can "lay legs on."

Genus **Lycosa**, Latr.

Lycosa uliginosa, sp. nov.

Female.—Length, 11 mm.; length of cephalothorax, 5 mm.; Legs, 4, 1, 2, 3 (1 and 2 almost equal) = (about) 17, 13, 12 mm.

Cephalothorax of a dusky-brown ground-colour, somewhat darker at the lateral margins than elsewhere, palest along the middle of the back; thoracic indentations marked by dark lines resembling veins: falces and sternum dark brown; labium and maxillæ brown; legs and palpi palish-brown with dusky-brown flecks and annulations; abdomen above and below of the same general hue as the cephalothorax. Cephalothorax and abdomen both without any distinct pattern, and covered (the latter much more densely than the former) with a fine greyish-yellow and brownish pubescence.

Cephalothorax more than 1 mm. longer than broad at the broadest part, rounded at the sides, much constricted at the caput, the sides of which are nearly vertical, lateral slope moderately and posterior slope very steep; seen in profile the back is almost level. The junction of the pars cephalica with the pars thoracica is marked by dark vein-like bands, one on each side, which converge at the anterior extremity of the thoracic fovea, the latter narrow, shallow, and brown, and extending just beyond the upper margin of the posterior declivity; ocular area very hairy, and between the middle and front row of eyes in the same plane with the clypeus.

Front row of *eyes* slightly curved upwards, and about as wide as the middle row, the eyes of nearly equal size, and posited at almost equal distances from one another; the eyes of the middle row the largest, more distant from each other than from the fore-laterals and nearer to each other than to those of the posterior row; the latter are posited behind black tubercles.

Falces convex towards the base and sloping backwards towards the extremities; on the posterior side of the groove 3 teeth with a fleshy prominence between the lowermost tooth and the base of the claw, on the anterior side 2 teeth; the teeth nearest the claw are the largest, and those furthest from it the shortest; claw stout at the base, and moderately bent.

Maxillæ convex, narrowest at the base, gradually increasing in width towards the fore extremity, more or less hollowed within to accommodate the lip, rounded on the outside, and slightly truncate on the inside in front, where there is the usual fringe. *Labium* convex, constricted at the base, widest towards the middle, and truncate in front.

Sternum slightly convex, oblong-cordate, strongly pointed posteriorly, glossy, and hairy.

Abdomen somewhat oblong, narrowest at the base, not so wide as the cephalothorax; spinners inconspicuous.

The *tarsi* of all the legs are without spines; the metatarsi and tibiæ of 3 and 4 have spines above and below, those of 1 and 2 below and at the sides only, (tibiæ of 1 and 2 with 2, 2, 2 below); the patellæ of 1 and 2 have no spines, and those of 3 and 4 have them above only. The spines at the fore extremity of the metatarsi of 3 and 4 are arranged in a ring round the joint. On the anterior side at the base the coxal joint is dark-brown, testaceous, and jagged. Tarsal claws 3, the two superior toothed at the basal half, the inferior one without teeth and strongly bent down, and concealed by a tuft of hair.

Humeral joint of palpi about as long as cubital + radial, stronger at the fore extremity than elsewhere, and longer than digital joint; radial joint longer than cubital; all the joints sparsely spinous above and at the sides; on the humeral joint 1, 1, 1, 4, or 1, 1, 4 spines; claw toothed and moderately bent from the teeth forward.

Vulva brown, forming in outline a narrow transverse ellipse, posterior margin highest in the middle and more rounded than the anterior margin, the latter consisting of two ear-shaped costæ with a wide and deep depression between them; the vulvular concavity divided into two foveæ, one on each side, separated by a very low gently sloping septum.

Mas.—Colour and pubescence like those of the female; body as long as and legs longer than the female's; cephalothorax longer and broader than the abdomen; humeral joint of palpi longer than cubital + radial, the former slightly longer than but not quite so strong as the latter; armature of humeral joint 1, 1, 1, 4 spines; digital joint beak-like and hollow at the base of the inferior surface; bulbus genitalis situated in this concavity; well developed, globular in outline, hollow in front, deeply cloven in the middle, and having, about half way between the base and the anterior margin, a transverse sinuous brown costa; from under the side of the inner lobe of the bulbus springs a long stout hollow corneous process which bends outwards and downwards, and from under the fore extremity of the outer lobe projects a small tooth-like process. The stout spines at the end of the digital joint somewhat resemble unpectinated claws.

Hab. Lake Wanaka, *P.G.*

The habit of this spider is similar to that of *Dolomedes aquaticus*. Both spiders are to be met with in the same wet situations on the shores of Lake Wanaka.

Lycosa bellicosa, sp. nov.

Female.—Length 11 mm.; length of cephalothorax, 5 mm. Legs 4, 1, 2, 3 = 14½, 11½, 11, 10 mm.

Cephalothorax brown, with a marginal band of pale yellow (or pale brown) extending from the posterior declivity to the caput, and a pale brown triangular fleck behind the posterior angle of the caput; falces dark brown; lip brown, palest anteriorly; maxillæ rusty brown; sternum of a bright bronze colour; legs and palpi brownish-yellow flecked with brown; abdomen above of a lighter general hue than the cephalothorax, and abundantly flecked with yellow (pale or brown); on the basal half a median longitudinal lanceolate stripe of yellow, and at the sides of this, and united with it, four flecks of the same hue, one on each side near the base, and one on each side at or near the posterior extremity of it. The pattern formed by the distribution of the colours resembles a double cross. The ventral surface is pale drab, except on each side near the base where it is brownish.

Cephalothorax more than 1 mm. longer than broad at the broadest part, only slightly rounded at the sides, not much constricted at the caput, the sides of which are nearly vertical, lateral and posterior slope steep; caput somewhat convex, large and prominent, and reaching backwards almost to the upper margin of the posterior declivity; face very prominent in the middle.

Front row of *eyes* slightly curved downwards, centrals somewhat larger than the laterals and nearer to each other than to them; laterals nearer to the eyes of the middle than to the centrals of their own row; front row wider than the middle; eyes of middle and posterior row not differing much in size, those of the latter posited behind black tubercles, and, like those of the middle row, furnished with eyebrows.

Falces very powerful, at the base projecting considerably beyond the clypeus, on the posterior side of the groove 3 teeth rather close together, on the anterior side 2 teeth, at a considerable distance from each other; claw short and moderately bent.

Maxillæ convex, smallest at the base, widest towards the extremities, slightly hollowed within to accommodate the lip, slightly rounded on the outside and truncate on the inside in front. *Labium* convex in front, about half as long as the maxillæ, constricted and depressed at the base, widest near the middle and truncate in front.

Sternum somewhat convex, oblong-cordate, pointed posteriorly, very glossy, and very sparingly furnished with hairs.

Abdomen very convex, and in well-grown examples not differing much in width from the base to near the posterior extremity; spinners rather conspicuous, the superior pair the longest and the central the shortest.

All the joints except the tarsi armed with spines, femora and patellæ above only, tibiæ and metatarsi above and below; tibiæ of 1 and 2 with 1, 2, 2 spines below, and metatarsi of 1 and 2 with 2, 2, 3; tarsal claws 3, the two superior toothed at the basal half, the inferior very small, without teeth, bent down vertically, and completely concealed by a tuft of hair.

Palpi slender, joints all armed with spines, humeral joint with 1, 1, 3; this joint considerably bent and stouter at the anterior extremity than elsewhere and about as long as cubital + radial, the latter somewhat longer than the former but not so strong, the digital joint longer than either of these two joints and armed with a pectinated claw.

Vulva brown, consisting of two rather narrow depressions, one on each side, each bounded anteriorly and laterally by a corneous costa, slightly depressed between the costæ, and here produced posteriorly into a short broad truncated lip-like process.

I have only an immature example of the male. The colours and markings are the same as those of the female.

Hab. Clutha Valley, Central Otago.

A very handsome little spider, and as pugnacious as it is handsome. When put into a bottle with other spiders it attacks them most savagely, and never ceases its attacks until it has either killed its antagonists or is itself killed. It digs a nest 2 to 3 inches deep, and lines it with a very thin coating of web, but does not make a door. Its nest resembles that of *Migas distinctus*, except that it is without a lid.

Art. XXI.—*Notes on* Amaurobioides maritima, *Cambridge.*[*]

By P. Goyen.

[*Read before the Otago Institute, 8th November,* 1887.]

This very interesting and handsome spider was discovered by the late Dr. Smith on rocks at Allday Bay, North Otago, and sent by Captain Hutton to the Rev. O. P. Cambridge, by whom it was figured and described in 1883. A mature and two immature examples were sent to him, labelled "Marine Spiders," but nothing was added to indicate in what sense they were marine. I have since found this spider at Shag Point, about twenty miles south of Allday Bay. It builds its nest in the clefts and crannies of rocks, some of which are at full tide exposed to the swell and battery of the South Pacific, and none are beyond reach of the spray from the breakers. Some of the nests are then completely under water. Though varying slightly with the shape of the clefts in which they are built, they are generally tubular in form, and consist of web which is of a leathery consistence and apparently impervious to water. The tubes are from one to two inches in length. At low tide the mouth is invariably open, and immediately in front of it there is often spun a short loose funnel-shaped snare. After the recession of the tide, and whilst the rocks were yet wet, I have sometimes found the mouth of the nest sealed up. Perhaps they are all so sealed when under water, but this is a point I have been unable to determine. It seems all one to the spider whether in or out of water; for I have frequently filled a nest with water, and its occupant has never shown any signs of discomfort. Taken from its nest and placed at the edge of a pool, it will, after a good deal of teasing, run down the side to the bottom, and there remain till all danger seems to have disappeared. Seen thus, its body covered with silvery globules of air, it is a very handsome object. Unlike *Robsonia marina*, Cambridge, it does not seek its prey in the water, but lies in wait at the mouth of its nest for the insects that abound on the rocks, in the clefts of which it builds. It is a plucky little animal, and fights very stoutly to retain possession of its nest.

The male is smaller and of a more slender build than the female, but exactly resembles her in colourations and markings. His cephalothorax is more rounded at the sides and more constricted at the caput, and his legs are longer than hers. Those of the fore pair are distinctly (1½mm.) longer than those of the hind pair. The male may be readily recognised from Cambridge's excellent figure of the female.

New Zealand is, I believe, the only country in which spiders have been found inhabiting the sea.

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[*] Proc. Zool. Soc., June, 1883, Pl. xxxvi., fig. 3.

II.—BOTANY.

Art. XXII.—*Notes on the Three Kings Islands.*

By T. F. Cheeseman, F.L.S.

[*Read before the Auckland Institute, 3rd October*, 1887.]

During the return voyage of the Colonial Government steamer *Stella* from the Kermadec Islands, Mr. Percy Smith and myself were enabled, through the kindness of Captain Fairchild, to land and spend two or three hours on the Three Kings Islands. As up to the time of our visit nothing whatever was known of the natural history of the Islands, and as their position at the extreme north of New Zealand renders any information on their plants, birds, &c., of value to those who are working out the geographical distribution of the flora and fauna of New Zealand, I propose to give an account of what we were able to observe during the short time at our disposal.

The Three Kings are a group of small islands situated about 33 miles W.N.W. of Cape Maria van Diemen. One of them is considerably larger than the rest, and is known as the Great King. It is about 1¾-mile in length, by ¾-mile in width; and its highest point, according to the Admiralty charts, is 997 feet above sea-level. Two smaller islands are called the East King and West King respectively. They are each of them somewhere near ½-mile in length, and about 600 feet in height. On the outside of the West King is a straight row of 8 or 9 tall conical rocks, terminated by a small island about 350 feet in height. This group is called the Prince's Islands, and has a most singular and picturesque appearance when seen from the distance of a mile or two.

The *Stella* approached the Great King on the S.E. side. Seen from the sea, the aspect of the island is barren and forbidding in the extreme. Black and rugged cliffs, bare of vegetation, and often several hundred feet in height, form the greater part of the shore, and against them a heavy surf continually rolls, the spray dashing far up their sides. The summit of the island appeared to be covered with short tea-tree, flax, and sedges, and gave little promise of anything but a very scanty vegetation. Steaming slowly along the eastern shore in search of a landing-place, we passed between the East King and the main island. Further to the northward the cliffs were still higher and more perpendicular, with numerous huge caves, into which the seas broke with a deep hollow roar. Rounding the next point we entered a deep bay, that almost cuts the island into two, and in which we obtained good shelter from the heavy easterly swell running outside. We anchored about a quarter of a mile from the shore, the depth being about 18 fathoms, and shortly afterwards landed with comparatively little difficulty at the head of the bay, on a rough boulder beach, everywhere encumbered with large masses of rock that had fallen from the cliffs above.

The cliff at the head of the bay is at least 850 feet high at its lowest point, and the climb to the top, although by no means difficult, was steep and rugged. The first plants noticed after leaving the beach were well-known maritime species, such as the ice-plant (*Mesembryanthemum australe*), the wild celery (*Apium australe*), *Spergularia rubra*, *Senecio lautus*, *Lobelia anceps*, *Isolepis nodosa*, etc. Scrambling among the rocks were large masses of *Sicyos angulatus*, and the pretty white-flowered *Angelica rosæfolia*. A little higher up, clumps of dwarf tea-tree were passed through, alternating with patches of flax (*Phormium tenax*) and toetoe grass (*Arundo conspicua*). A few small trees of the rare *Pisonia umbellifera* were noticed, one of them covered with the viscid seed-vessels that so often catch small birds, such as the white-eye or fan-tail, that are so unfortunate as to touch them. Here, too, a handsome new *Pittosporum* was gathered, allied to the karo (*P. crassifolium*) and to *P. umbellatum*. It differs from the first in the broader flat leaves, which are quite glabrous when mature, and from the second in the fewer flowers and very differently shaped seed-vessels. It has ornamental foliage, and its mode of growth is neat and compact, so that it will prove an acceptable addition to our gardens. I have named it *Pittosporum fairchildi*, in honour of the well-known commander of the *Stella*. Two other shrubs deserve mention: *Hymenanthera latifolia*, a scarce plant in New Zealand, except on outlying islands of similar character to the Three Kings, but of common occurrence in Norfolk Island; and the glossy-leaved *Coprosma baueriana*, so very plentiful on maritime rocks all round the North Island. On some rocky ledges near the top of the cliffs a handsome fern new to New Zealand was collected. It belongs to the genus *Davallia*, and is probably a variety of the well-known Australian and Norfolk Island *D. pyxidata*. It was afterwards found to be plentiful over the greater part of the island. Reaching the top of the cliff, we found ourselves only a short distance from the head of another bay, stretching in from the south side, and which, with the one we had left, very nearly divides the island into two. As we had not time to explore both portions, a start was made for the highest peak, which is situated in the north-western half of the island.

The vegetation on the top of the island is mainly composed of stunted tea-tree (*Leptospermum scoparium*) mixed with flax (*Phormium tenax*), common fern (*Pteris aquilina*), and some common sedges. A few ericetal plants grow in the shelter of the tea-tree, such as *Leucopogon fraseri*, *Pimelea prostrata*, *Haloragis alata* and *H. depressa*, *Lagenophora forsteri*, *Gnaphalium involucratum*, etc. In one or two places, near the edge of the cliffs, some worn and stunted pohutukawas (*Metrosideros tomentosa*) can be found. In the deeper gullies, (several of which, it should be mentioned, contain nice little streams of water,) the tea-tree attains a greater size, and is mixed with shrubs or small trees, but there is nothing approaching the dimensions of an ordinary forest tree. Descending from the highest peak into one of those gullies, the first plant of interest noticed was a new species of *Coprosma*, with the habit of the common karamu (*C. robusta*), but with leaves fully twice the size, and berries as large as small plums—in fact, the fruit is much the largest of the genus. For this plant I propose the name of *Coprosma macrocarpa*. Along the margin of the little stream which occupies the bottom of the gully were large masses of the rare *Colensoa physaloides*, which must present a charming appearance when covered with the pale blue flowers. Lower down a few small trees appeared, as the mahoe (*Melicytus ramiflorus*), wharangi (*Melicope ternata*), and mangeao (*Tetranthera calicaris*). Among them was a remarkable new species, very distinct from any plant hitherto found in New Zealand. It falls into the genus *Paratrophis* (the *Epicarpurus* of the "Handbook"), but belongs to the section *Uromorus*, of which only three species were previously known—one inhabiting the Fiji Islands, another Tahiti, and a third the Philippine Islands. The occurrence of a fourth species in New Zealand is a very extraordinary and inexplicable circumstance. I have ventured to associate with it the name of my fellow-traveller, Mr. Percy Smith.

A few tree-ferns were noticed, but all of one species (*Cyathea medullaris*). Of smaller ferns, *Pteris tremula*, *P. comans*, *Lomaria procera*, *Doodia media*, *Asplenium flaccidum*, *Aspidium richardi*, and *Polypodium billardieri* were all plentiful. So also was *Lomaria acuminata*, which has not been previously recorded from New Zealand, although abundant in Norfolk Island and Sunday Island.

I append a list of the flowering plants and ferns noticed, in all 82 species. Of this number five are new to the New Zealand flora, three of them being new to science. The list is far from being complete, and will be materially added to when the island is thoroughly explored. My visit was too short to allow me to do more than examine a small portion; and I had no opportunity of landing on either the East or West King, both of which are covered with light bush, and doubtless have plants not found on the main island.

The following land birds were noticed on the Great King:—The common hawk (*Circus gouldi*), morepork (*Athene novæ-zealandiæ*), kingfisher (*Halcyon vagans*), tui (*Prosthemadera novæ-zealandiæ*), white-eye (*Zosterops lateralis*), utick (*Sphenœacus punctatus*), grey warbler (*Gerygone flaviventris*), ground lark (*Anthus novæ-zealandiæ*), pied fantail (*Rhipidura flabellifera*), red-fronted parrakeet (*Platycercus novæ-zealandiæ*), quail (*Coturnix novæ-zealandiæ*). Of the last mentioned I saw two individuals, and another one was seen by Mr. Percy Smith and Mr. Hazard. Its occurrence on the Three Kings was quite unexpected; and as it is nearly, if not altogether, extinct on the mainland, we may congratulate ourselves that it has been found in a locality where it is likely to remain undisturbed for many years to come. Besides the species named above, another one is common which I failed to identify. It is about the size of the bell-bird, and has much of its appearance and habits, but the under-parts are greyish-white, and the song is altogether different. I regret that I was unable to obtain a specimen, for there is little doubt that it will prove to be an addition to our lists.

The Three Kings were discovered in 1648 by the celebrated Dutch navigator Tasman. As his account of the discovery is very little known, and as it possesses some interest from proving that the islands were inhabited in his time, I will quote it here:—

"January 4, 1648. This morning we were near a cape of land (Cape Maria van Diemen), and had an island N.W. by N. from us. We hoisted the white flag for the officers of the *Zeehaan* to come on board, and we resolved to stand for the island to look for fresh water and greens. We find a strong current setting westward, and much sea from the N.E., from which we hope to find a clear passage eastward. In the evening we were near the island, but could not observe that anything we wanted might be got here.

"The 5th, in the morning, we had little wind and a calm sea. About noon, we sent Francis Jacobsz in our shallop, and the supercargo, Mr. Gillemans, in the *Zeehaan's* boat to the island, to try if fresh water could be got. In the evening they returned, and reported that they had been in a safe small bay where fresh water came in abundance from a high mountain; but that there was a great surf on the shore, which would make watering there troublesome and dangerous. They rowed further round about this island to look if there was any more convenient place. Upon the highest mountain of the island they saw 35 persons, who were very tall, and had staves or clubs. These people called to them in a strong rough voice. When they walked, they took very large strides. On other parts of the island a few people were seen here and there, which, with those already mentioned, were thought to be all or nearly all the inhabitants of the island. Our people saw no trees, nor did they observe any cultivated land, except that near the fresh water there were some square plots of ground, green, and very pleasant; but of what kind the greens were they could not distinguish. Two canoes were drawn up on the shore.

"In the evening we anchored in 40 fathoms, good ground, a musket-shot distant from the island (on the north side).

"The 6th, in the morning, we put water-casks in the two boats, and sent them to the shore. As they rowed towards the land, they saw tall men standing in different places, with long staves like pikes in their hands, who called to our people. There was much surf at the watering place, which made landing difficult; and between a point of the island and another very high cliff, or little island, the current ran so strong against the boats that they could scarcely stem it: for which reasons the officers held counsel together, and not being willing to expose the boats and the people, they returned to the ships. Before we saw them coming back, we had fired a gun and hoisted a flag as a signal for them to return. This island we named Drie Koningen Eyland, *i.e.*, Three Kings Island (on account of this being the day of the Epiphany)."

From the number of Natives seen by Tasman, and from the fact that patches of cultivated ground were observed, we may take it for granted that the islands had permanent residents at the time of his visit. But they must have been subsequently abandoned, for all the voyagers immediately after Cook speak of them as being uninhabited; one or two, however, stating that the Maoris were in the habit of crossing from the mainland, at long intervals, to obtain young mutton-birds or gannets. In 1816, the ship *Betsey*, commanded by Captain Goodenough, was wrecked near the North Cape, and the greater portion of the crew were drowned. The survivors, nine in number, took refuge on the Three Kings, being driven from the mainland by the threatening conduct of the Maoris. They lived there for some time, and saw no appearance of the islands having been inhabited for many years past. Somewhere about 1830, however, a number of Maoris belonging to the Aopuri tribe crossed over and took up their residence on the islands. They were led by a well-known chief, who in his younger days had spent some time in a whaling vessel, and had received the nick-name of Tom Bowline. He, with his wife and immediate followers, remained on the islands for many years, and had several children born there. From a paragraph in the "Missionary Register" for 1886, it appears that the Rev. Mr. Puckey visited the Three Kings in October, 1885, being induced to go there through hearing a report that the inhabitants were starving. He found them almost in a state of destitution, and offered to bring them away, but they decided not to leave their homes. I have been unable to obtain the date of Tom Bowline's departure, but he eventually left the island, and took up his residence in a little bay to the west of the North Cape, which still bears on our charts the name of Tom Bowline's Bay. Since his time, I believe that no one has lived on the islands, and casual visitors have been very few indeed.

A short time ago the title to the Three Kings became the subject of an investigation by the Native Lands Court. Judge Monro, who presided when the case was heard, has very kindly furnished me with notes of the evidence that was taken. According to Wiremu Kurukuru, who claimed the islands as the representative of Tame Porena (Tom Bowline), the Three Kings were originally inhabited by a race of people differing in some respects from the Maoris. The tribe numbered about a hundred, and its principal chief was called Toumaramara. A chief of the Aopuri called Taiakiaki invaded the islands, and a battle was fought, which resulted in the death of Toumaramara and all his people, with the exception of one woman called Te Poinga. Taiakiaki did not remain on the islands; but one of his sons called Tongahake very frequently crossed over from the mainland. He died on the Great King, and was buried there. His daughter, called Turangakahu, married Tom Bowline, and accompanied him when he crossed over to reside on the islands. She had four daughters born there, and they were all adults when Tom Bowline returned to the mainland. Another witness, called Herepeti Kingi, who claimed to be a lineal descendant of Toumaramara, denied that that chief and his people were destroyed by Taiakiaki, but the balance of the evidence appears to be against him. Rewiri Kaiwaka, a Ngapuhi native, stated that his father conveyed Tom Bowline to the islands. He did not remain with him, but returned, after obtaining some birds and some goat-skins. The goats had been placed there a little while before by some Europeans. He used the skins to make sails for his canoes.

Mr. Percy Smith informs me that some Aopuri natives state that the original owner of the Three Kings was a chief called Rauru. This Rauru, in ages long past, swam across to the islands from the mainland, and, being much exhausted and out of breath when he landed, called the place "Manawa-tawhi," which, being translated, means "panting breath." This name it has retained up to the present time. It seems very desirable that the Maori traditions respecting the islands should be collected by some qualified person before they disappear.

The Three Kings may some day be occupied as a fishing-station, but it is difficult to imagine what other use could be made of them. They are quite unsuited for cultivation, very difficult of access, and landing is more often dangerous than not. Probably many years will elapse before the peculiar plants and birds are in any way interfered with by human residents.

DESCRIPTIONS OF THE NEW SPECIES.

1. *Pittosporum fairchildi*, n. sp.

A small tree, 3 – 15 feet in height; branches rather slender, bark brownish. Young branchlets and peduncles more or less covered with whitish tomentum, which gradually disappears as they mature. Leaves entire, alternate, often crowded, variable in shape, obovate, elliptic-obovate, or elliptic-oblong, 2 – 4 inches long, obtuse or acute, gradually narrowed into short stout petioles, coriaceous, bright-green and glossy above, paler below, margins flat, veins finely reticulated, covered with silky white hairs when young, but quite glabrous when old. Flowers purplish, ⅓ inch long, in terminal 2 – 4-flowered fascicles, pedicels rather long, slender, decurved. Sepals linear-oblong, acute, tomentose. Petals much larger, recurved. Capsules terminal, 3-valved, ¾ – 1 inch in diameter, depressed, broader than long, glabrous, even when half-grown, valves hard and woody, dark-brown, very finely wrinkled and pitted.

I have named this fine species after Captain Fairchild, of the s.s. *Stella*, through whose kindness I was enabled to land on the islands. It is allied to *P. crassifolium* and *P. umbellatum*. From the first it differs in the broader flat leaves, which are quite glabrous when mature, and in the capsule, which is smaller and much broader and flatter, besides being glabrous when comparatively young. From *P. umbellatum* it can at once be distinguished by the silky tomentose young leaves and branchlets, less numerous flowers, and by the much larger differently-shaped capsule.

2. *Coprosma macrocarpa*, n. sp.

A robust, leafy, glossy-green shrub, 5 – 12 feet in height, quite glabrous in all its parts; bark dark greyish-brown. Leaves coriaceous, but hardly so much so as in *C. robusta*, large, 4 – 7 inches long, 1½ – 3½ inches broad, ovate-oblong or elliptic-oblong, acute or apiculate, rather suddenly narrowed into a short stout petiole, margins thickened; veins conspicuous, very finely reticulated. Stipules large, on the young leafy shoots often sheathing the branch for some distance. Flowers not seen. Fruit much the largest of the genus, very abundantly produced, in axillary fascicles of 3 – 7, ½ – 1 inch long, broadly ovoid or oblong, or sometimes nearly orbicular, not seen perfectly ripe.

A very distinct plant, at once recognised by the large fruit, which is more than twice the size of that of *C. grandifolia* or *C. robusta*, which are its nearest allies. The leaves are often as large as those of *C. grandifolia*, but they have more the shape and texture of those of *C. robusta*, and they dry a brownish-black as in that species. The average length of the fruit is about ¾ inch, but some specimens were observed over an inch. The flowering season was past at the time of our visit, but judging from the arrangement of the berries, the inflorescence must resemble that of *C. grandifolia*, with shorter peduncles and fewer flowers.

3. *Paratrophis* (*Uromorus*) *smithii*, n. sp.

A small tree, 10–15 feet high, with milky juice, perfectly glabrous in all its parts; branches long, slender, straggling; bark brown, rough, with raised lenticles. Leaves shortly petiolate, alternate, entire, 5–9 inches long, 2–4 inches broad, ovate-oblong, oblong-elliptical or almost ovate, obliquely cordate at the base, sub-coriaceous, obtuse or obtusely acuminate, veins conspicuous, penninerved. Stipules small, lanceolate, very deciduous. Spikes simple or bifid, axillary, 2–5 inches long, only females seen, and those with the flowers not quite fully developed. Flowers apparently arranged in two irregular rows on each side of the spike, numerous, minute, mixed with peltate scales. Perianth 4-partite to the base; leaflets broadly ovate, obtuse, imbricate. Ovary sessile, ovoid, exserted beyond the perianth. Style divided to the base into two linear stigmatic branches. Fruit a drupe, enclosed at the base in the slightly enlarged persistent perianth, globose, ½-inch long, bright red. Seed solitary, pendulous.

A singular species, which I have dedicated to my fellow-traveller, Mr. Percy Smith. Technically, it falls into the genus *Paratrophis*, as defined by the authors of the "Genera Plantarum," the type of which is the plant well known to New Zealand botanists under the name of *Epicarpurus microphyllus*. *P. smithii*, however, belongs to a section of the genus called *Uromorus*, which was originally constituted as a distinct genus by Bureau, in his monograph of the order (De Candolle's "Prodromus," vol. xvii.). Three species of the section are known: one from the Fiji Islands, one from Tahiti, and the third from the Philippines. Ours is very distinct from all.

4. *Davallia*, sp.

Rhizome stout, wide-creeping, densely clothed with pale chestnut-brown subulate cobwebby scales. Stipes stiff, smooth, 3–6 inches long. Frond 4–12 inches long, 3–8 inches broad, deltoid or rhomboid, tri- or quadripinnatifid, very coriaceous, quite glabrous. Primary pinnæ ovate-deltoid, acuminate; secondary narrower; pinnules lanceolate, cut down nearly to the base into 3–5 pairs of segments. Sori numerous, narrow cup-shaped, sunk in the top of the teeth, usually with a projecting horn on the outer side.

This is evidently closely allied to the Australian and Norfolk Island *D. pyxidata*, and but for the fact that my specimens hardly match an Australian specimen of *D. pyxidata* in my herbarium, I should have considered them to be the same. As it is, I leave the species unnamed until a more complete comparison can be made.

Catalogue of Plants observed on the Three Kings Islands.

1. *Clematis indivisa*, Willd.
2. *Clematis parviflora*, A. Cunn.
3. *Cardamine hirsuta*, L.
4. *Melicytus ramiflorus*, Forst.
5. *Hymenanthera latifolia*, Endl.
6. *Pittosporum fairchildi*, n. sp.
7. *Spergularia rubra*, Pers.
8. *Oxalis corniculata*, L.
9. *Melicope ternata*, Forst.
10. *Coriaria ruscifolia*, L.
11. *Haloragis alata*, Jacq.
12. *Haloragis depressa*, Hook. f.
13. *Leptospermum scoparium*, Forst.
14. *Leptospermum ericoides*, A. Rich.
15. *Metrosideros tomentosa*, A. Cunn.
16. *Metrosideros scandens*, B. and S.
17. *Sicyos angulatus*, L.
18. *Mesembryanthemum australe*, Sol.
19. *Hydrocotyle heteromera*, D.C.
20. *Hydrocotyle novæ-zealandiæ*, D.C.
21. *Apium australe*, Th.
22. *Angelica rosæfolia*, Hk.
23. *Corokia cotoneaster*, Raoul.
24. *Coprosma macrocarpa*, n. sp.
25. *Coprosma grandifolia*, Hk. f.
26. *Coprosma baueriana*, Endl.
27. *Coprosma robusta*, Raoul.
28. *Lagenophora forsteri*, D.C.
29. *Gnaphalium involucratum*, Forst.
30. *Gnaphalium collinum*, Lab.
31. *Senecio lautus*, Forst.
32. *Sonchus oleraceus*, L.
33. *Wahlenbergia gracilis*, A. Rich.
34. *Colensoa physaloides*, Hk. f.
35. *Lobelia anceps*, Thunb.
36. *Leucopogon fraseri*, A. Cunn.
37. *Myosotis spathulata*, Forst.

38. *Convolvulus sepium*, L.
39. *Convolvulus tuguriorum*, Forst.
40. *Dichondra repens*, Forst.
41. *Pisonia brunoniana*, Endl.
42. *Muhlenbeckia complexa*, Meisn.
43. *Tetranthera calicaris*, Hk. f.
44. *Hedycarya dentata*, Forst.
45. *Pimelea prostrata*, Vahl.
46. *Paratrophis smithii*, n. sp.
47. *Parietaria debilis*, Forst.
48. *Peperomia urvilleana*, A. Rich.
49. *Piper excelsum*, Forst.
50. *Acianthus sinclairii*, Hk. f.
51. *Microtis porrifolia*, Spr.
52. *Thelymitra longifolia*, Forst.
53. *Cordyline australis*, Hk. f.
54. *Dianella intermedia*, Endl.
55. *Arthropodium cirrhatum*, Br.
56. *Phormium tenax*, Forst.
57. *Scirpus nodosus*, Rottb.
58. *Cladium teretifolium*, Br.
59. *Uncinia australis*, Br.
60. *Carex paniculata*, L., var. *virgata*.
61. *Carex testacea*, Sol.
62. *Carex breviculmis*, Br.
63. *Panicum imbecille*, Forst.
64. *Echinopogon ovatus*, Pal.
65. *Arundo conspicua*, Forst.
66. *Poa anceps*, Forst.
67. *Cyathea medullaris*, Swz.
68. *Davallia*, sp.
69. *Adiantum affine*, Willd.
70. *Adiantum hispidulum*, Swz.
71. *Pteris tremula*, Br.
72. *Pteris aquilina*, L.
73. *Pteris comans*, Forst.
74. *Lomaria acuminata*, Baker.
75. *Lomaria procera*, Spr.
76. *Doodia media*, Br.
77. *Asplenium obtusatum*, Forst.
78. *Asplenium flaccidum*, Forst.
79. *Aspidium richardi*, Hook.
80. *Polypodium serpens*, Forst.
81. *Polypodium billardieri*, Br.
82. *Lycopodium volubile*, Forst.

Art. XXIII.—*On the Flora of the Kermadec Islands; with Notes on the Fauna.*

By T. F. Cheeseman, F.L.S., Curator of the Auckland Museum.

[*Read before the Auckland Institute, 14th November*, 1887.]

A few months ago the Colonial Government dispatched the steamer *Stella* to the Kermadec Islands, for the purpose of formally annexing the group to the Colony of New Zealand; and through the kind offices of the Assistant Surveyor-General, Mr. Percy Smith, I received permission to accompany the expedition. Mr. Smith has contributed to the Institute an account of the physical features and geology of the islands; I propose to describe the chief characteristics of the flora, and its relationship to that of New Zealand, also to Norfolk Island and Lord Howe's Island, both of which are very similar in character to the Kermadec Islands, and are situated in the same latitude. To this I shall ask leave to add some scattered notes on various branches of the fauna, and a few general considerations on the probable mode by which the islands have received their plants and animals.

The Kermadec Group consists of a chain of widely separated small islands, four in number, situated between 29° 10′ and 31° 30′ S. lat., and stretching in a south-west and north-east direction over more than 140 miles. The largest of the islands, Raoul, or Sunday, is about 20 miles in circumference. It is the furthest from New Zealand, being rather more than 640 miles from Auckland, and a little less than that distance from Tonga. The next in size, Macaulay Island, is 68 miles to the south-west of Sunday Island. The remaining two, Curtis and L'Esperance, are still further to the south-west, but they are little more than mere rocks. On the last mentioned we were unable to land; and bad weather rendered our visit to Curtis Island a very brief one. My remarks must, therefore, be in great measure confined to Sunday and Macaulay Islands.

The depth of the ocean between the islands, so far as is known, varies from 500 to 600 fathoms. In the map accompanying the narrative of the *Challenger* expedition, the 1,000 fathom line is shown to enclose the whole of the group within a narrow elliptical area about 200 miles in length. To the north-east and south-west, on a line drawn through the islands from Tonga to New Zealand, the depth varies from 1,000 to 2,000 fathoms. Immediately to the eastward, however, much deeper water is found, and stretches all the way across the Pacific to the American coast. A large triangular patch, over 2,000 fathoms in depth, occurs also to the west and north-west of the group, in the direction of Norfolk Island and New Caledonia. The Kermadec Islands may, therefore, be said to rest on a broad submarine ridge connecting New Zealand with Tonga and Fiji. A similar but much broader ridge joins New Zealand, by way of Norfolk Island and Lord Howe's Island, with New Caledonia and North-eastern Australia.

The sole knowledge previously existing of the vegetation of the Kermadec Islands was based on a small collection of plants made on Sunday Island, in July, 1854, by Messrs. Milne and McGillivray, the naturalists attached to H.M.S. *Herald* during her surveying voyages in the South Seas. This collection was placed in the hands of Sir J. D. Hooker, and formed the subject of a very interesting paper entitled "On the Botany of Raoul Island," which is printed in the "Journal of the Linnean Society" (vol. i., Botany, pp. 125–129). The total number of species collected was 41 (42 are enumerated in the list, but two plants now usually considered to be varieties are treated as distinct species).

The conclusions arrived at by Sir J. D. Hooker from his study of the collection may be summarised as follows:—(1.) That the flora is most nearly allied to that of New Zealand, the greater portion of the species being absolutely identical with plants found in that country; (2.) That there is a remarkable absence of any of the plants peculiar to Norfolk Island, which is almost exactly the same distance from the Kermadec Islands as New Zealand; and (3.) That the proportion of Polynesian species is much less than might have been reasonably expected.

I may at once say that the larger and more complete collection that I have been able to make bears out, in the main, the above conclusions; for, although I have been able to prove that some of the peculiar Norfolk Island plants do occur on Sunday Island, and although some Polynesian species not known to Hooker are also found there; still, there can be no doubt, to use Sir J. D. Hooker's own words, that the affinities of the flora "are most strong with that of New Zealand, and feeble to a very unaccountable degree with the flora of those other groups with which it might be expected to possess a very strong relationship."

Seen from the distance of a mile or two, SUNDAY ISLAND has much of the appearance of some of the outlying islands off the New Zealand coast. Like most of these, it is high, steep, and almost mountainous, intersected with numerous ravines, and with a bold coast line, the cliffs often plunging abruptly into the sea. The beach, with the exception of two sandy bays, is everywhere composed of boulders and masses of rock; and as there is no harbour, or moderately sheltered bay, landing is always difficult, and sometimes dangerous. Although situated on the verge of the tropics, it has none of the characteristics of a tropical island, and its vegetation, when seen from a moderate distance, has precisely the monotonous dull brownish-green tint so noticeable while sailing along the shores of New Zealand.

In shape, Sunday Island is roughly triangular. Its greatest length, from Hutchinson Bluff, the western termination of the island, to Wilson Point on the east side, is about 6¼ miles. The greatest breadth, measuring from Fleetwood Bluff on the north to Smith Bluff at the southern extremity of Denham Bay, is a little over 4 miles. The total area is estimated by Mr. Smith at 7,260 acres. It is purely volcanic in structure, and the centre of the island is occupied by a large crater more than a mile in diameter. The encircling rim of this is steep, and in many places precipitous. On the south side its average height is over 1,000 feet, rising in the south-east corner to 1,720 feet, the highest point on the island; but on the north it is much lower, falling in one place to 180 feet. The floor of the crater is undulating, and contains three little crater lakes, by the side of one of which steam is still escaping. The soil is rich and fertile, but exceedingly porous, so much so that there are no permanent streams, although the rainfall is evidently large, and distributed pretty equally over the whole year.

Except a limited area on the floor of the crater, the whole of the island is covered with forest, from the water's edge to the tops of the highest peaks. The prevailing tree, forming two-thirds or more of the vegetation, is the widely diffused *Metrosideros polymorpha*, which seems to range through the greater part of Polynesia, from the Sandwich Islands and Tahiti to Fiji and New Caledonia. It is very closely allied to our pohutukawa (*M. tomentosa*), differing chiefly in its rather smaller size, smaller rounder leaves, and smaller clusters of flowers. Young trees growing on level ground are often very symmetrical in shape, with numerous closely placed branches, but on the steep ridges, where it attains its greatest size, it is much more distorted and gnarled. Sometimes the trunk or main branches spread out horizontally a few feet above the ground, sending up numerous erect branches, which at a distance look like separate trees. It produces the only really good and durable timber found on the island, and might be applied to all the purposes for which pohutukawa is used.

Next to the *Metrosideros*, the most abundant and conspicuous plant is a palm, which I take to be *Kentia baueri*, hitherto supposed to be confined to Norfolk Island. It is a much larger and more handsome species than our nikau (*Kentia sapida*), with a stouter cleaner stem, and more numerous leaves with broader leaflets. It was in fruit at the time of our visit, and the bright red berries, collected in large clusters at the top of the trunk, had a very fresh and pretty appearance. It is not nearly so fond of secluding itself in the recesses of the forest as the nikau, and often flourishes in the open, exposed to both sun and wind. On some terraces of rich volcanic soil on the northern side of the island it forms large groves, to the exclusion of almost all other trees. I was surprised at the deepness of the shade in these groves—one would have thought that such a gloom could only have been produced by the overlapping branches and foliage of tall forest trees.

A fine tree-fern (*Cyathea milnei*), which is peculiar to the island, is also very plentiful, especially towards the tops of the hills, and in all the ravines. It is often 50 or 60 feet in height, and is thus quite equal in stature to our *Cyathea medullaris*, which it much resembles.

Two common New Zealand trees, the well-known karaka (*Corynocarpus lævigatus*) and the ngaio (*Myoporum lætum*) are abundant, especially near the sea. The last mentioned is much more variable in the shape of its leaves than is usual in New Zealand. Abandoned cultivations are soon overrun with it. Other trees of frequent occurrence are the wharangi (*Melicope ternata*), mahoe (*Melicytus ramiflorus*), tupaki (*Coriaria ruscifolia*), and the whau-whau-paku (*Panax arboreum*), all of them familiar plants to the New Zealand botanist. The kawakawa or pepper-tree (*Piper excelsum*) is also very generally distributed, but it is much more luxuriant, and has much larger leaves and flower-spikes than the New Zealand form, and appears to be certainly worthy of distinction as a sub-species at the least.

Three trees appear to be confined to the island, and to be found nowhere else: a *Coprosma* (*C. acutifolia*) allied to our *C. tenuifolia*, but a more slender plant, with very different inflorescence; a new species of *Myrsine*, not very far removed from the Norfolk Island *M. crassifolia*, but sufficiently distinct; and a handsome plant belonging to the Polynesian genus *Carumbium*. The last mentioned has a most graceful mode of growth, and very handsome foliage. Young trees form slender unbranched rods, 6–15 feet in height, with large leaves, sometimes 18 inches in diameter. When old, it branches after the manner of some poplars, and the leaves become very much smaller. If hardy in this climate, it will prove a very ornamental addition to our gardens.

The well-known "candle-nut" of Polynesia (*Aleurites moluccana*), a plant common in the tropics of both hemispheres, occurs in a few localities, but is decidedly scarce. A small grove on the north side of the island contains some examples over 60 feet in height, with trunks 3 feet in diameter, but its usual size is rather less than that. The ground underneath the trees is always thickly covered with the fallen nuts. These contain an abundance of fine hard oil, so that in some parts of Polynesia the kernels are strung on a string and lighted as candles.

Other trees deserving notice are *Bœhmeria australis*, hitherto supposed to be confined to Norfolk Island; *Cordyline terminalis*, the common "Ti" of Polynesia; *Pisonia brunoniana*, a Polynesian and Norfolk Island plant, found in a few scattered localities on the coast of New Zealand; and the littoral plants karo (*Pittosporum crassifolium*), *Coprosma petiolata*, and *C. baueriana*.

The herbaceous plants may be passed over with less detail. In both the sandy bays, the tropical *Ipomœa pes-capreæ* is plentiful. Its running stems are often quite 30 or 40 feet in length, and with its large fleshy two-lobed leaves give the plant a very odd appearance. A very different species of the same genus, *I. palmata*, occurs on the cliffs in one or two places. *Canavalia obtusifolia*, a common maritime plant in tropical regions, was observed on Meyer Island, a rocky islet distant about a mile and a half from the northern coast of Sunday Island. *Sicyos angulatus* is one of the commonest plants in the lower portions of the island, creeping over the ground, and festooning the trees to a considerable height. It is a very troublesome weed in the cultivations. *Scævola gracilis* is one of the few plants peculiar to the islands, and is plentiful in rocky places, both on the sea-cliffs and inland. It has handsome white fragrant flowers, and would make a good garden plant. *Haloragis alata*, *Hydrocotyle moschata*, *Lagenophora forsteri*, and *Parietaria debilis*, all well-known New Zealand plants, are of frequent occurrence. Three Composites—*Bidens pilosa*, *Ageratum conyzoides*, and *Siegesbeckia orientalis*, with *Solanum nigrum*, are everywhere present in open or cultivated ground. The *Ageratum*, which has received the local name of "cherry pie" or "wild heliotrope," is a most troublesome weed, and has taken complete possession of the old cultivations in Denham Bay, forming a dense growth 3–4 feet high. It is possible that both it and the other three plants are naturalized, but there is no direct evidence of this, and as they are all widely distributed in many tropical and sub-tropical countries, and have all the appearance of being true natives, it seems best to consider them as such.

The common bulrush (*Typha angustifolia*) is found in a lagoon in Denham Bay, and in the crater lakes. It seems to be the only true marsh plant on the island. Sedges are rare: two species of *Carex*, which cannot be identified until better specimens are obtained, are plentiful in open places in the forest; and our "cutting-grass" or toe-toe (*Cyperus ustulatus*) is everywhere present at low elevations, readily taking possession of the abandoned cultivations. Grasses are more abundant, and include several tropical species not found in New Zealand. The handsome *Imperata arundinacea* is particularly plentiful on the cliffs.

Ferns are wonderfully numerous and luxuriant, and compose over one-fourth of the entire flora. They form the chief undergrowth in the forest, filling every ravine and hollow place, and descend the cliffs to the level of the sea. Even in the banana plantations they appear as weeds, *Pteris comans* being particularly abundant in such situations, forming a dense tangled mass 5 feet in height or more, which is soon renewed if cut down. The species most generally distributed are *Cyathea milnei*, *Pteris comans*, and *P. tremula*, *Aspidium aristatum*, *Hypolepis tenuifolia*, *Asplenium flaccidum*, *Lomaria acuminata*, and *Doodia media*. Our common fern, *Pteris aquilina*, is decidedly scarce, and is apparently confined to a locality in Denham Bay and another near Fleetwood Bluff. A few tropical species were added to those already known to inhabit the island, the most interesting being *Nephrolepis exaltata*, which is abundant in Denham Bay; *Nephrodium setigerum*, not uncommon in most of the ravines; and an *Asplenium* of the *Diplazium* section, which was only noticed in a ravine on the north side of the island, but was plentiful enough there.

My visit was too short to allow me to make collections of any size in the other families of cryptogams. Mosses and liverworts are abundant, but the species are few in number. The larger foliaceous lichens, of the genera *Sticta*, *Parmelia*, etc., are pretty frequent, both on trees and rocks. Very few fungi were noticed, but then the time of our visit was probably unfavourable for them.

Naturalised plants are not so numerous as might have been anticipated, considering that small portions of the island have been cultivated for forty years. One of the commonest and most conspicuous weeds is the Cape gooseberry (*Physalis peruviana*), which rapidly overruns deserted cultivations. I observed one patch of three or four acres that was almost entirely covered with it, to the exclusion of other vegetation. *Stellaria media*, *Cerastium vulgatum*, *Senebiera coronopus*, *S. didyma*, *Erigeron canadensis*, *Senecio vulgaris*, and *Veronica arvensis*, are all plentiful, and pretty generally distributed in suitable places.

The cultivated plants of Sunday Island have a thoroughly tropical aspect, and make a strong contrast with the indigenous vegetation. The cultivations are mostly little plots on terraces of fertile volcanic soil, or sunny nooks in the open gullies. Several varieties of bananas are grown; a tall coarse kind attains nearly 25 feet in height, with leaves 12 to 15 feet in length. Four or five varieties of the taro, three of yams, and two or three of kumaras are cultivated, and appear to do very well. The sugarcane, the pineapple, the guava, the custard-apple, the rose-apple, the pomegranate, the papaw, the mango, oranges, shaddocks, citrons, &c., are all grown to some extent, and look healthy and thriving. Evidently the climate and soil are favourable for the cultivation of many tropical and subtropical fruits; and if frequent and regular communication existed, such might be profitably grown for the New Zealand market. I may add that the ordinary cultivated fruits and vegetables of Europe, so far as they have been tried, succeed very fairly indeed.

The second of the group, MACAULAY ISLAND, is about 1¼ miles in length, by about a mile in greatest breadth. It is everywhere surrounded by high vertical cliffs, ranging from over 700 feet at the west end to about 150 feet at the eastern point of the island. Access to the top can only be obtained at one place, where a lava stream has fallen over the cliffs, and formed a rough natural staircase. On reaching the top of the cliffs the surface of the island is seen to be gently undulating, with a gradual slope from the west. There are several shallow gullies, and in one of them small pools of water were seen; but, as on Sunday Island, there are no permanent streams. It is entirely covered with a beautiful sward of natural grass, apparently composed of a species of *Poa* and an *Agrostis*; but in the absence of flowers I cannot be sure of the determinations. There are no trees or woody plants of any kind, with the exception of a few stunted bushes of *Carumbium*, and two or three dwarf ngaios (*Myoporum*). A few small herbaceous plants, as *Gnaphalium involucratum*, *Haloragis alata*, *Oxalis*, *Erigeron*, etc., were scattered here and there among the grass. Tussocks of toe-toe (*Cyperus ustulatus*) fringed the edges of most of the gullies; and a few ferns were found in sheltered nooks along the sides of the dry water-courses. The ice-plant (*Mesembryanthemum australe*), *Scævola gracilis*, *Tetragonia expansa*, *Lobelia anceps*, and *Coprosma petiolata*, were all plentiful on the cliffs. The flora must be considered as very scanty, only 88 species being observed.

CURTIS ISLAND is rather more than 20 miles to the south-west of Macaulay Island. It is nearly half-a-mile in length, and about 450 feet in height; but is little more than the rocky rim of a still partly active crater. The crater-wall is broken down on the north-west side, where there is a sheltered little cove, so that landing can be effected within the crater itself, in proximity to numbers of steam jets and boiling mud-pools. Our stay was so short that it was impossible to ascend the cliffs to examine the vegetation on the top of the island, where several green patches had been noticed from the deck of the *Stella*. The only plants actually identified were *Mesembryanthemum australe* and *Lobelia anceps*, which were growing on a mud-flat on the floor of the crater. A grass, and some bushes of what seemed to be *Coprosma petiolata*, were also observed on the face of the cliffs a short distance from the landing place. In all probability a dozen species of flowering plants will exhaust the flora of the island.

Appended to this paper will be found a catalogue of the flowering plants and ferns collected in the group. The total number of species is 115; but only 5 of these, or $\frac{1}{23}$rd, are endemic, a remarkably small proportion considering the isolated position of the islands. Seventy-four species are now recorded for the first time, and 20 of these are new to the New Zealand flora. Only one species is new to science.

Having thus described the chief features of the flora, we may now proceed to inquire into its relationship and origin. We have already seen that the Kermadec Islands are far removed from any large land masses. The nearest part of New Zealand is distant about 600 miles. The Tongan or Friendly Isles are a little over 500, while New Caledonia is nearly 950. To the west, the continent of Australia is separated by more than 1,500 miles of ocean. In the intervening space, however, there are two islands which have several features in common with the Kermadecs, and to which it seems advisable to draw special attention. I allude to Norfolk Island and Lord Howe's Island.

NORFOLK ISLAND, situated about 420 miles north-west of the North Cape, and 840 miles east of Australia, is almost exactly the same distance from Sunday Island as New Zealand, and very nearly the same size, its area being estimated at 8,000 acres. Like Sunday Island, it is purely volcanic, but is not so lofty and rugged. It has always been noted for its fertility, and at the time of its discovery was covered with a most luxuriant vegetation. Its plants were first examined by the celebrated botanical artist, Ferdinand Bauer, who in the years 1804 and 1805 lived for several months on the island. His collections were worked out by the late Professor Endlicher, and fully described in a little pamphlet entitled, "Prodromus Floræ Norfolkicæ," published at Vienna in 1833. The island has since been botanized over by several travellers, and is probably pretty well explored. So far as I can make out, the total number of species recorded from the island is 146; and of these no less than 36, or one-fourth, are peculiar, and not found elsewhere. Several of them have been introduced into cultivation, the Norfolk Island pine (*Araucaria excelsa*) being a well-known example. The flora is certainly very closely allied to that of New Zealand, and some plants—for instance, *Phormium tenax*—are absolutely confined to the two localities. It is, however, much more tropical, and is probably more closely connected with that of North-eastern Australia and New Caledonia.

LORD HOWE'S ISLAND is 1,200 miles from Sunday Island, and 750 from New Zealand. Its distance from Australia is barely

850 miles. Its area is almost exactly the same as that of Norfolk Island and Sunday Island, but it is much more mountainous than either, Mount Gower, the highest peak, being 2,840 feet high. Its flora is pretty well known, chiefly through the exertions of Mr. Charles Moore, the Director of the Sydney Botanic Gardens, and other Australian naturalists. Most of the new species have been described by Baron Mueller in his "Fragmenta Phytographiæ Australiæ," where also a carefully-compiled catalogue of the flora is given. Two hundred and two species have been collected on the island, 51 being peculiar to it—exactly the same proportion that obtains on Norfolk Island. Many New Zealand plants occur; but the chief relationship of the flora is with New Caledonia and North-eastern Australia.

To show clearly what are the affinities of the Kermadec flora it is necessary to give a few figures. Of the 115 species collected by me in the group, no less than 85 are found in New Zealand, or very nearly four-fifths of the entire flora. Fourteen of the 85 are absolutely confined to the two localities. Forty-four species are found in Norfolk Island, but of these no less than 40 are found in New Zealand, and there are only two plants confined to Norfolk Island and the Kermadec Group. Forty extend as far as Lord Howe's Island, but 34 of these occur in New Zealand, and none of the peculiar Lord Howe's plants reach the Kermadecs. Seventy-six plants are common to Australia and the Kermadecs, but none of these are peculiar Australian species, and 68 of them are natives of New Zealand, the remainder occurring in Polynesia. Lastly, 47 Kermadec species are Polynesian, 81 of them being found in New Zealand as well. Two plants are peculiar to the Kermadec Islands and Polynesia.

It is impossible to doubt the significance of these figures; they clearly point to New Zealand as the origin of the major portion of the flora of the group. Admitting that one-half or more of the Kermadec plants are species having a very wide distribution, occurring not only in New Zealand but also in Norfolk Island, Lord Howe's Island, Australia, and many of them also reaching Polynesia; yet the fact that they are accompanied by a large proportion of plants otherwise confined to New Zealand, affords very good reason for supposing that the greater portion, if not all, are immigrants from thence. Had they made their way from any other source, in all probability some of the endemic plants of that country would also have made good an entrance. For instance, we have seen that Norfolk Island and Lord Howe's Island possess nearly 50 of the Kermadec plants. Now these islands contain 86 peculiar species. They are in the same latitude as the Kermadec Islands, and one of them is as near as New Zealand. Their climate, geological structure, and physical features generally, are very similar to those of Sunday Island.

Yet only two of their peculiar plants have migrated to the Kermadec Group. Had the 40 widely distributed species that are common to Norfolk Island and the Kermadecs immigrated directly from Norfolk Island, a larger proportion of the endemic plants of that island would undoubtedly have followed them. Similarly, 76 plants of wide geographical range are found both in Australia and the Kermadec Group; yet I cannot believe that they have migrated direct from Australia. Surely, if that had been the case, a few, at least, of the many hundred endemic Australian species would have accompanied them.

We have seen that, out of the 115 species collected in the group, 85 are New Zealand plants. This leaves 30 to be accounted for. Five are peculiar to the group, and 5 more cannot be determined until flowering specimens are obtained. Two are strictly Polynesian species, and the remaining 18 are wide-ranging tropical or sub-tropical plants, many of them common in both hemispheres, and all of them found in Polynesia, coming as near to the Kermadecs as Tonga. Probably it is from thence that the Kermadecs have received them. Taking the above data into consideration, it appears to me most probable that the Kermadec Islands have received their plants from two sources: that there have been two opposite streams of colonization—one, much the largest and most important, from New Zealand; the other, much less conspicuous, from the Polynesian Islands.

In coming to this conclusion, it is assumed that the Kermadec Islands have always been isolated from other land masses, or, at any rate, have not formed part of any other land during the tertiary period. But views opposed to this are often held. In endeavouring to solve the difficult and much-debated question of the origin of the New Zealand fauna and flora, it is usually assumed that New Zealand was formerly connected, by way of Norfolk Island and Lord Howe's Island, with North-eastern Australia and New Caledonia; and, as mentioned at the commencement of this paper, a submarine ridge—nowhere much more than 1,000 fathoms in depth, and for a considerable part of the distance much less than that—actually extends in the right direction. This theory has the merit of accounting for two salient features in the natural history of New Zealand. It shows how the ancestors of our struthious birds may have arrived from a country at present inhabited by their nearest living representatives; and it explains, if taken in connection with certain very probable geological changes in Australia, how the very anomalous nature of the relationship of our flora with that of Australia may have arisen. But it is unnecessary to go into the details of the theory here—they can be found in Mr. Wallace's "Island Life," or in Professor Hutton's papers "On the Origin of the New Zealand Fauna and Flora."

It is not quite clear whether Norfolk Island and Lord Howe's Island are to be considered as remnants of this former extension of New Zealand, or as evidences of volcanic activity since its subsidence in whole or in part. Their flora certainly lends some support to the first view, for, in addition to possessing considerable affinity with that of New Zealand, it is undoubtedly much more closely allied to that of North Australia and New Caledonia than it is to that part of temperate Australia nearest to them and situated in the same latitude. The large proportion of endemic species also goes to prove that the islands are of considerable antiquity. With respect to the fauna, the presence of a species of *Ocydromus* in Lord Howe's Island, and of *Nestor* in Norfolk Island, cannot but be regarded as highly suggestive.

No doubt a considerable amount of probability attaches to the supposed former extension of New Zealand to the north-west. But an extension to the north-east has not nearly such cogent evidence in support of it. In the first place, the submarine ridge connecting New Zealand with the Kermadec Group, and through it with Tonga and Fiji, is much narrower, and, so far as can be judged from the few soundings taken, is covered with much deeper water. This would put back the subsidence of the land to a more remote period. But the flora of the Kermadec Islands is composed almost wholly of plants living in New Zealand or Polynesia, the proportion of endemic species being only $\frac{1}{23}$, against $\frac{1}{4}$ in Norfolk Island and Lord Howe's Island. This undoubtedly demands that the connection should be of recent date. Again, had there been land uniting New Zealand with Tonga and Fiji, there should, as Mr. Wallace states, be more community between the natural history productions of the two localities. Every botanist knows that the Polynesian element in the New Zealand flora is small and unimportant; and, although some branches of the fauna are perhaps more closely connected, even there the affinity is by no means close. The scanty and fragmentary nature of the Kermadec flora, and the still more scanty fauna, are not what we should expect to find had the islands been connected with better peopled countries; while they are quite in harmony with the view that they have received their inhabitants by trans-oceanic migration. I must admit feeling much scepticism as to the likelihood of any recent extension of New Zealand towards the north-east. In all probability, if a land connection with Polynesia in that direction ever existed, it had disappeared long before the origin of the Kermadec Islands. According to Mr. Percy Smith's observations, the two chief islands are mainly composed of distinctly stratified pumiceous tuffs, evidently deposited under water. In the absence of fossils, their age cannot be precisely fixed; but they must be assigned to a comparatively recent period.

There are three principal ways by which the seeds of plants can be carried across wide spaces of ocean: by wind, by ocean currents, and by birds. The first mode is chiefly applicable in the case of the spores of ferns and cryptogamic plants generally; and it is no doubt through it that ferns constitute such a large proportion of the flora of almost all oceanic islands. But with respect to flowering plants, its importance is, I think, very much over-rated. Had it operated to any extent, plants possessing light seeds, or seeds furnished with winged appendages or down (*pappus*), would be common on most oceanic islands. But this does not always happen, and is certainly not the case with the Kermadec Group. Distribution by means of ocean currents is a more promising mode, and it can be shown to be a likely one in the case of the Kermadec Group. It is well-known that in the whole of the southern portion of the South Pacific the drift of the ocean is to the north, forming what is called the antarctic drift current. This current hugs both shores of New Zealand, and extends to the North Cape; but is usually said to disappear about latitude 34°, and to be succeeded by a broad expanse of ocean in which the currents are variable or hardly perceptible. But in examining the shores of Sunday Island Mr. Smith and myself were surprised to find numerous kauri logs, evidently drifted from New Zealand. Mr. Bell informed us that over forty were lying stranded on the beaches, and from what I saw myself I do not think his estimate is much above the mark. The logs bore brands of different dates, and, apart from that, it was evident from their appearance that they had arrived at different periods, so that it cannot be assumed that a specially favourable gale, or temporary current, had drifted over a batch that had made its escape from some of our timber-mills. Probably the antarctic current extends further to the north in this portion of the Pacific than has hitherto been supposed. But if logs are regularly drifted across, so may seeds, branches of trees bearing seed-vessels, and vegetable *débris* of all kinds. Many seeds are capable of germination after a prolonged submersion in salt water. Mr. Darwin proved by actual experiment that some retained their vitality after an immersion of over 100 days; and M. Gustave Thuret has succeeded in getting the seeds of nine species to germinate after being floated for thirteen months in a vessel of salt water. Even in 100 days the branch of a tree bearing ripe seed-vessels might be floated across a distance even greater than that separating New Zealand from Sunday Island. Dispersal through the agency of birds might also be the means of stocking the Kermadec Islands with some plants. Most of the birds found in the group are New Zealand species; and in the case of sea-birds, such as the various species of albatrosses and petrels, which possess immense powers of flight and range over large distances of ocean, yearly breeding on outlying islands, it would be an easy matter for seeds adhering to the feathers, or included in earth attached to the feet, to be conveyed across wide spaces of ocean.

In concluding my remarks on the flora, I may be allowed to repeat my conviction that its nature and composition, its relationship to that of New Zealand and Polynesia, and its peculiarities generally, are best explained on the supposition that the islands have been slowly stocked with their plants by chance migrations across the ocean.

My visit to the islands was so brief, and so much time was lost by exceptionally stormy weather, that little systematic work could be accomplished with the fauna. The following notes are based on observations made at odd moments, while engaged in examining the vegetation.

Mammals.—The only mammal that possesses any claim to be indigenous is a rat, and of this I was unfortunately unable to obtain a specimen. Mr. Bell informed me that it is abundant in the summer months, but uniformly disappears in the winter, in his opinion to hibernate. At the time of my visit I supposed that it had been introduced by some of the early settlers, but since my return I find that Lieut. Watts, in his account of the first discovery of the group in 1788, says that "a great number of rats and mice were seen on Macaulay Island." This would seem to prove that the species, whatever it may be, is truly indigenous. It is somewhat singular that there is no bat. Norfolk Island has a peculiar species; but Mr. Bell was positive that none exists on Sunday Island.

Birds.—The following species were collected or observed in the group, with the exception of one or two, specified in the list, which are inserted on the authority of Mr. Bell:—

1. Common Hawk (*Circus gouldi*). Not uncommon on Sunday Island and Macaulay Island.

2. Kingfisher (*Halcyon vagans*). Sunday Island; plentiful.

3. Tui (*Prosthemadera novæ-zealandiæ*). The commonest bird on Sunday Island. Its note differs slightly from that of its New Zealand relatives, but the plumage is precisely the same.

4. White-eye (*Zosterops lateralis*). Seen on both Sunday and Macaulay Islands, but not plentiful.

5. Lark (*Anthus novæ-zealandiæ*). Two or three specimens noticed on Macaulay Island.

6. Red-fronted Parrakeet (*Platycercus novæ-zealandiæ*). Mr. Bell stated that this formerly existed on Sunday Island, but had been exterminated by the wild cats. On Meyer Island, an outlying rock off the coast of Sunday Island, it is still plentiful. On Macaulay Island it is in great numbers, going about in flocks

of from 12 to 50, hopping among the short grass, and apparently feeding on the seeds of *Erigeron* and *Gnaphalium*. So tame was it, and so unused to man's presence, that I caught two by simply walking quietly up and suddenly putting my hat over them while they were walking on the grass. Several more were caught by the sailors of the *Stella* in a similar way.

7. Long-tailed Cuckoo (*Eudynamis taitensis*). Mr. Bell showed me the tail of a specimen of this species. According to him, it is a yearly visitant, but is never very plentiful.

8. Shining Cuckoo (*Chrysococcyx lucidus*). Also stated by Mr. Bell to be an occasional visitor. I did not see it.

9. Pigeon (*Carpophaga* sp. ?). Mr. Bell informed us that a large fruit-pigeon, which he thought was the same as the New Zealand species, was formerly not uncommon, but had been killed off by the cats.

10. Pukeko (*Porphyrio melanotus*). A single specimen was noticed in the lagoon in Denham Bay.

11. Grey Duck (*Anas superciliosa*). Said by Mr. Bell to exist in the crater lakes, but to have been very scarce since the eruption of 1872. I did not see it; but Mr. Bell is confident as to its identity with the New Zealand species.

12. Grey Noddy (*Anous cinereus*). I believe that I am correct in referring a pretty little tern, very plentiful all through the group, to this species. I obtained several specimens, which agree very well with the description in Gould's "Handbook."

13. Albatross (*Diomedea exulans*). A few individuals were noticed during the voyage to and from the islands. According to Mr. Bell, it breeds on the Chanter Islands, some small rocks off the north-east coast of Sunday Island.

14. Mollymauk (*Diomedea melanophrys*). Plentiful. Breeds on Curtis Island.

15. Sooty Albatross (*Diomedea fuliginosa*). Noticed at sea between Sunday and Macaulay Islands.

16. Small Shearwater (*Puffinus assimilis*). Abundant on Meyer Island, where it was breeding in great numbers at the time of our visit.

17. Mutton Bird (*Puffinus* sp.). A species of this genus, clearly different from any of the New Zealand forms, breeds on Sunday Island in September and October, laying its eggs on the bare ground among the trees on the hill-sides. The young birds, when cured, form no inconsiderable portion of the food of the residents, and are by no means bad eating. The old birds had only just commenced to arrive at the time of our visit, but during the middle of the season they are present in enormous numbers. Large portions of the island are then entirely covered

with them, and the noise and confusion is said to be almost indescribable.

18. Cape Pigeon (*Procellaria capensis*). Plentiful at sea all round the group.

19. Stormy Petrel (*Thalassidroma melanogaster*). Plentiful everywhere at sea.

20. Gannet (*Dysporus* sp.). A fine gannet, differing from the New Zealand species in wanting the buff-coloured feathers on the head, was not uncommon, but I was unable to obtain a specimen.

21. Tropic-bird (*Phaeton rubricauda*). Breeds on the islands in the month of October, according to Mr. Bell. I did not see it.

22. Frigate-bird (*Tachypetes aquilus*). Mr. Bell informed us that the frigate-bird visits the island regularly every spring and summer; but none were observed during the visit of the *Stella*.

In addition to the above, several petrels were seen at sea, which could not be identified from the deck of the vessel. It is worthy of remark that the whole of the land-birds are common New Zealand species.

Reptiles.—No land reptilia of any kind were observed, and Mr. Bell informed us that none exist. He alluded, however, to the occasional presence of a water-snake, which, from his description, I take to be *Pelamys bicolor*, a common species throughout Polynesia. Several specimens of the common turtle (*Chelonia viridis*) were seen, and it is said to be not uncommon during the summer months.

Fishes.—The following were caught by the sailors of the *Stella* during our stay (I had not time to collect any myself):—Hapuka (*Oligorus gigas*), plentiful, and attaining a large size; specimens weighing over 80lbs. were caught. Kahawai (*Arripis salar*), abundant. Trevally (*Caranx georgianus*). Kingfish (*Seriola lalandii*), very large and fine-flavoured. *Scorpæna* sp. Tarakihi (*Chilodactylus macropterus*), and a few others not yet identified.

Mollusca.—A large limpet, more than 5 inches in diameter, is common on the rocks, and there are two or three species of smaller size. *Nerita atrata*, *Triton spengleri*, *Ranella leucostoma*, *Cassis pyrum*, all well-known New Zealand species, were collected. Worn specimens of *Conus marmoreus* and another species of the same genus, together with *Cypræa caput-serpentis*, were picked up on the beach. Two or three *Trochidæ* of Polynesian facies were also picked up; but, as a rule, shells are very few in number, as might be predicted from the heavy surf continually rolling on the shore. The only land mollusca observed were broken fragments of two species of *Helicidæ* of small size.

CATALOGUE OF PHÆNOGAMIC PLANTS AND FERNS INHABITING THE KERMADEC ISLANDS.

(Species new to the New Zealand Flora marked with an asterisk.)

1. CRUCIFERÆ.

1. *Cardamine stylosa*, D.C.

Open gullies on Macaulay Island; not uncommon. Not seen on Sunday Island. New Zealand, Australia, Tasmania.

2. VIOLARIEÆ.

2. *Melicytus ramiflorus*, Forst.

Plentiful on Sunday Island, especially on the rich volcanic terraces on the northern side of the island. New Zealand, Norfolk Island.

3. PITTOSPOREÆ.

3. *Pittosporum crassifolium*, Banks and Sol.

A few trees scattered along the northern shore of Sunday Island. New Zealand.

4. GERANIACEÆ.

4. *Geranium dissectum*, L., var. *pilosum*.

Cliffs on the northern shore of Sunday Island; not common. Temperate regions of both hemispheres.

5. *Geranium molle*, L.

In various places on Sunday Island, but perhaps naturalised only. New Zealand, Tasmania, Europe, N. Africa, W. Asia.

6. *Oxalis corniculata*, L.

Common on both Sunday Island and Macaulay Island. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and most parts of the world.

5. RUTACEÆ.

7. *Melicope ternata*, Forst.

Sunday Island; plentiful. Foliage and capsules much larger than in New Zealand examples, and the plant might be appropriately distinguished under the name of var. *grandis*. New Zealand.

6. ANACARDIACEÆ.

8. *Corynocarpus lævigata*, Forst.

Plentiful in all the lower portions of Sunday Island. New Zealand.

7. Coriarieæ.

9. *Coriaria ruscifolia*, L.

Sunday Island; abundant, especially in the large crater-basin. New Zealand.

10. *Coriaria thymifolia*, Humb.

Recorded from the Kermadec Islands by *Sir J. D. Hooker* in the "Handbook of the New Zealand Flora," p. 47; but not mentioned in his paper printed in the "Journal of the Linnean Society" (vol. i., Botany, p. 125). I did not observe it, and judging from its distribution in New Zealand it does not seem a likely plant to occur in the islands. New Zealand; America, from Mexico to Peru.

8. Leguminosæ.

11. **Canavalia obtusifolia*, D.C.

Stems long, prostrate or climbing, glabrous, or the young shoots silky-pubescent. Leaves trifoliate; leaflets obovate or orbicular, obtuse, 2–4 inches long, texture firm. Flowers in axillary racemes, rather large, pinkish. Upper lip of calyx very large, with two broad rounded lobes; lower lip small, three-lobed. Standard orbicular, ¾ inch diameter; keel curved, obtuse. Pod about 4 inches long by nearly 1 inch broad; seeds 3 to 6. Scrambling over rocks and shrubs on Meyer Island, an outlying rock on the north side of Sunday Island. Mr. Bell informed me that it occurs in some bays on the east side of Sunday Island. Norfolk Island, Lord Howe's Island, tropical Australia, and a common sea-coast plant in many parts of Polynesia, South America, Africa, and tropical Asia.

9. Rosaceæ.

12. *Acæna sanguisorbæ*, Vahl.

Kermadec Islands, *Sir J. D. Hooker* ("Handbook," p. 56). I did not see this, and the plant was unknown to Mr. Bell. New Zealand, Australia, Tasmania, Tristan d'Acunha.

10. Halorageæ.

13. *Haloragis alata*, Jacq.

On both Sunday and Macaulay Islands, but by no means abundant. New Zealand, Australia, Juan Fernandez.

14. *Callitriche verna*, L.

Abundant in shady places on Sunday Island. World-wide, or nearly so.

11. MYRTACEÆ.

15. *Metrosideros polymorpha*, Forst.

Sunday Island; the most abundant tree, occurring from sea-level to the summit of the highest hills. Lord Howe's Island, and in many parts of Polynesia, extending as far north as the Sandwich Islands. Apparently not found in Norfolk Island.

12. CUCURBITACEÆ.

16. *Sicyos angulatus*, L.

Plentiful in the lower portions of Sunday Island, and of very luxuriant growth, climbing to the tops of the trees. It also creeps over the ground, and is a great nuisance in the cultivations, on account of the rapidity of its growth. New Zealand, Norfolk Island, Lord Howe's Island, Australia, America.

FICOIDEÆ.

17. *Mesembryanthemum australe*, Sol.

Shores of Sunday, Macaulay, and Curtis Islands; abundant. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

18. *Tetragonia expansa*, Murr.

Shores of Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Japan, extra-tropical South America.

19. *Tetragonia trigyna*, Banks and Sol.

Cliffs on the north side of Sunday Island; not common. New Zealand, and also Australia and Tasmania, if it is identical with *T. implexicoma*, Hk. f., as seems probable.

14. UMBELLIFERÆ.

20. *Hydrocotyle moschata*, Forst.

Moist places on Sunday Island; plentiful. New Zealand.

21. *Apium australe*, Thou.

Shores of Sunday Island; not rare. New Zealand, Lord Howe's Island, Australia, Tasmania, Antarctic America.

15. ARALIACEÆ.

22. *Panax arboreum*, Forst.

Sunday Island; common towards the tops of the hills. New Zealand.

16. RUBIACEÆ.

23. *Coprosma baueriana*, Endl.

Eastern shore of Sunday Island; not common. New Zealand, Norfolk Island.

24. *Coprosma petiolata*, Hook. f.

Shores of Sunday, Macaulay, and Curtis Islands; plentiful. New Zealand, Lord Howe's Island, Norfolk Island.

25. *Coprosma acutifolia*, Hook. f.

Plentiful all over Sunday Island. The female flowers, which were not known to Hooker, are on slender peduncles ½ – ¼ inch long, which are either simple or trichotomously divided, and bear from 4 to 12 flowers. Calyx with 4–5 linear teeth. Corolla tubular, 3 – 5-lobed. Drupe oblong, ¼ inch long, reddish orange. Distinguished from my *C. tenuifolia* by its more slender habit, paler bark, smaller, thinner, and more acuminate leaves, with different venation, and by the much less compact inflorescence. Endemic.

17. Compositæ.

26. **Ageratum conyzoides*, L.

Sunday Island; abundant, especially in abandoned cultivations, where it forms a dense mass 2–3 feet high. Known by the local name of "Cherry Pie," or "Wild Heliotrope." Perhaps introduced, but it is truly native in many parts of Polynesia. Abundant in the tropics of both hemispheres.

27. *Lagenophora forsteri*, D.C.

Cliffs in Denham Bay, Sunday Island. New Zealand.

28. *Lagenophora petiolata*, Hook. f.

Kermadec Islands, *Sir J. D. Hooker* ("Handbook," p. 137). Not observed by me. New Zealand.

29. **Siegesbeckia orientalis*, L.

Sunday Island; common in open sunny places in the bush. Tropical Australia, Polynesia, India, China.

30. *Bidens pilosa*, L.

Sunday Island; plentiful everywhere in open and rocky places. New Zealand, Australia, Polynesia, and tropical countries generally.

31. *Cotula australis*, Hook. f.

Sunday Island; not uncommon in waste places. New Zealand, Australia, Tasmania, and Tristan d'Acunha.

32. *Gnaphalium luteo-album*, L.

Sunday and Macaulay Islands; common. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and most parts of the world.

3. *Gnaphalium involucratum*, Forst.

Sunday and Macaulay Islands; not rare. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Japan.

34. *Gnaphalium collinum*, Lab.

Macaulay Island, plentiful; Sunday Island, not so abundant. New Zealand, Australia, Tasmania.

35. *Senecio lautus*, Forst. ?

Macaulay Island; only a few specimens seen, and these so young that the identification is doubtful. New Zealand, Australia, Tasmania.

36. *Senecio* (?) sp.

A plant possibly belonging to this genus occurs on the cliffs on the eastern shore of Sunday Island, but the specimens are much too immature to determine. The foliage somewhat resembles that of *S. banksii*, Hook. f.

37. *Sonchus oleraceus*, L., var. *asper*.

Common on the cliffs of both Sunday and Macaulay Islands. New Zealand, Australia, and most temperate regions.

18. GOODENOVIEÆ.

38. *Scævola gracilis*, Hook. f.

Sunday and Macaulay Islands; abundant on the cliffs. A very ornamental half shrubby procumbent plant, 2 to 4 feet high. Flowers white with a yellow eye, sweet-scented. Endemic.

19. CAMPANULACEÆ.

39. *Wahlenbergia gracilis*, A. Rich.

Sides of dry gullies on Macaulay Island. New Zealand, Lord Howe's Island, Australia, Malayan Islands.

40. *Lobelia anceps*, Thunb.

Sunday and Macaulay Islands; common. A large and stout broad-leaved form. New Zealand, Norfolk Island, Lord Howe's Island, Australia, S. Africa, and temperate South America.

20. PRIMULACEÆ.

41. *Samolus repens*, Pers.

Maritime rocks on the east side of Sunday Island. New Zealand, Australia, New Caledonia.

21. MYRSINEÆ.

42. **Myrsine kermadecensis*, n. sp.

Common all over Sunday Island. Evidently closely allied to the Norfolk Island *M. crassifolia*, but I think sufficiently distinct. I defer describing it until I am able to compare specimens of the two plants. Endemic.

22. CONVOLVULACEÆ.

43. *Convolvulus sepium*, L.

Waste places on Sunday Island; rare. New Zealand, Australia, and most temperate and sub-tropical regions.

44. *Convolvulus soldanella*, L.

East coast of Sunday Island; apparently not common. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and most extra-tropical sea coasts.

45. *Ipomœa palmata*, Forst.

Cliffs on the north side of Sunday Island; not uncommon. New Zealand, Norfolk Island, Lord Howe's Island, Australia; tropical Asia, Africa, and America.

46. **Ipomœa pes-capræ*, Roth.

Perfectly glabrous. Stems prostrate, trailing, sometimes 40 feet in length. Leaves 2–4 inches long, broadly-oblong or orbicular, bluntly 2-lobed, thick and fleshy. Peduncles shorter than the leaves, 1–3-flowered. Calyx with 5 obtuse sepals. Corolla campanulate, 1 inch long, pinkish. Capsule large, nearly globose, ¾ inch in diameter, 2-celled. Seeds large, hairy. Abundant in the sandy bays and on some of the cliffs of Sunday Island. Lord Howe's Island, Australia, Polynesia, and the sea-coasts of most tropical countries.

23. SOLANACEÆ.

47. *Solanum nigrum*, L.

Sunday Island; most abundant, especially in cultivated ground. Macaulay Island, not so plentiful. New Zealand, Australia, Polynesia, and almost all tropical and temperate countries.

48. *Solanum aviculare*, Forst.

Sunday Island; by no means common. Macaulay Island, a single specimen only. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

24. SCROPHULARINEÆ.

49. *Veronica salicifolia*, Vahl.

Cliffs on the east side of Sunday Island; rare. New Zealand.

50. *Veronica ligustrifolia*, Vahl.

Stated by Sir J. D. Hooker to have been collected by McGillivray on Sunday Island. I did not observe it; but Mr. Bell informed me that a narrow-leaved "Koromiko" occurred in a few localities, which will doubtless be this species. New Zealand.

25. MYOPOREÆ.

51. *Myoporum lætum*, Forst.

One of the commonest trees on Sunday Island, and the first to appear on abandoned cultivations. It is much more variable in its foliage than in New Zealand, and unusually broad- and narrow-leaved varieties are common. A few stunted plants were noticed on Macaulay Island. New Zealand.

26. CHENOPODIACEÆ.

52. *Rhagodia nutans*, Br.

Cliffs on the north side of Sunday Island. New Zealand and Australia.

27. POLYGONACEÆ.

53. *Rumex flexuosus*, Forst.

Sandy beach in Denham Bay, Sunday Island. New Zealand.

28. NYCTAGINEÆ.

54. *Pisonia brunoniana*, Endl.

Scattered over the lower portions of Sunday Island, but by no means common. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and Polynesia.

29. EUPHORBIACEÆ.

55. **Aleurites moluccana*, Willd.

A stout, widely-branched tree; Sunday Island specimens ranging from 20 feet to 60 feet in height, with a trunk 1–3 feet in diameter. Leaves crowded towards the ends of the branches, alternate, 4–9 inches long, ovate-lanceolate to rhomboid, 3–5-lobed, acute or acuminate, tomentose when young, almost glabrous when fully grown; petioles 3–9 inches long. Panicles large, terminal, much branched. Flowers monœcious, not seen in a perfect condition, the calyx and corolla having just fallen before the time of our visit. Fruit almost 2 inches in diameter, usually with 2–3 cocci. Seeds globose, rugose, hard, and bony. North and east side of Sunday Island; not very common. North Australia, Polynesia, and the tropics of both hemispheres.

56. *Carumbium polyandrum*, Hook. f.

Sunday Island; not uncommon in sheltered places. Macaulay Island; half-a-dozen plants in the old crater basin. A graceful tree, with very handsome glaucous foliage, variable in shape and size. The leaves of young plants are often more than a foot in diameter; but they are seldom half that size in fully grown individuals. Endemic.

80. Urticeæ.

57. *Parietaria debilis*, Forst.

Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and the tropics of both hemispheres.

58. **Bœhmeria australis*, Endl.

A small tree, 8–20 feet high. Branches terete, hoary with minute appressed hairs. Leaves alternate, ovate-lanceolate to ovate, acuminate, obtusely serrate, rounded or slightly cordate at the base, 3–6 inches long; 3-nerved, green and glabrous above, below white and hoary with appressed hairs. Petioles stout, grooved on the upper surface, ½-1½ inches long. Stipules small, deciduous, ovate-lanceolate. Flowers minute, in small axillary sessile glomerules, nearly all females in my specimens, but in one or two the lower glomerules have male flowers at the base of the glomerule. Male flowers: Perianth deeply 4-partite, segments oblong-ovate, acuminate, covered with erect hairs. Stamens 4, alternating with the perianth segments; filaments elastic, exserted and recurved between the perianth segments when the flower is mature. A minute oblong-clavate rudiment of an ovary present. Females: Perianth tubular, compressed, dilated below, contracted at the two-toothed mouth. Ovary included, 1-celled, 1-ovulate; stigma exserted, long, filiform, spirally recurved, hirsute. Ripe fruit not seen. This seems to differ from Endlicher's plant in the leaves not being so decidedly cordate at the base. Sunday Island; not uncommon in the lower portions of the island. Norfolk Island.

81. Chloranthaceæ.

59. *Ascarina lucida*, Hook, f.

Sunday Island; plentiful on the hills. I have followed Sir J. D. Hooker in referring the Kermadec plant, which he originally distinguished under the name of *A. lanceolata*, to the New Zealand *A. lucida*. But the leaves are much longer and narrower, and more coarsely toothed, than in any New Zealand specimens I have seen. New Zealand, Fiji, Samoa, New Caledonia.

82. Piperaceæ.

60. *Piper excelsum*, Forst.

Extremely plentiful all over the lower portions of Sunday Island. Differs from the New Zealand plant in the very much longer leaves and longer catkins. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

61. *Peperomia urvilleana*, A. Rich.
Sunday Island; plentiful. New Zealand, Norfolk Island, Lord Howe's Island.

83. ORCHIDEÆ.

62. *Acianthus sinclairii*, Hook. f.
Sunday Island; abundant. New Zealand.

63. *Microtis porrifolia*, Spr.
Shaded places in the crater of Sunday Island. Flowers not seen, and the identification is therefore not certain. New Zealand, Australia.

84. LILIACEÆ.

64. **Cordyline terminalis*, Kunth.
Stems 3–8 feet high. Leaves numerous, crowded at the end of the stems, 12–18 inches long, 2–3 inches broad, oblanceolate, acuminate, gradually narrowed into a sheathing petiole 2–6 inches long. Panicle large, 1–2 feet long. Flowers in clusters of 2 or 3 on the branches of the panicle, shortly pedicelled, lilac. Perianth about ⅓ inch long, divided about half-way down into 6 segments. Ripe fruit not seen. Lower portions of Sunday Island; not very common. Australia, Polynesia, Malayan Islands, India.

85. PALMEÆ.

65. **Kentia baueri.*
Abundant on Sunday Island, from sea-level to the tops of the highest hills. I refer it to the Norfolk Island *K. baueri* with some hesitation, for I have had no opportunity of comparing specimens; but it seems to match Endlicher's description very fairly, so far as foliage and fruit are concerned. Unfortunately it was not in flower at the time of my visit. It differs from *K. sapida* in the larger size (some specimens reaching 60 feet), stouter habit, more numerous leaves, much larger panicles, and larger nearly globose fruit. Norfolk Island.

86. TYPHACEÆ.

66. *Typha angustifolia*, L.
Sunday Island; fringing the lakes in the crater basin, and also in a lagoon in Denham Bay. Nearly all temperate and tropical countries.

87. CYPERACEÆ.

67. *Cyperus ustulatus*, A. Rich.
Sunday and Macaulay Islands; plentiful. New Zealand.

68. *Scirpus nodosus*, Rottb.
Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Lord Howe's Island, Australia, South Africa, extra-tropical South America.

69. *Carex* sp.

Sunday and Macaulay Islands. The specimens are not sufficient to determine the species, but the leaves much resemble those of the Norfolk Island *C. neesiana*.

70. *Carex* sp.

Sunday Island. Smaller, and with narrower foliage than the preceding.

38. GRAMINEÆ.

71. *Paspalum scrobiculatum*, L.

Denham Bay, Sunday Island. New Zealand, Australia, Polynesia, tropical Asia and Africa.

72. **Panicum* (*Digitaria*) *sanguinale*, L.

Sunday Island; plentiful, and apparently truly native. Lord Howe's Island, Australia, Polynesia, and most warm countries.

73. **Panicum* (*Digitaria*) sp.

Shaded places on Sunday Island.

74. **Oplismenus compositus*, Beauv.

Shaded places on Sunday Island; abundant. Lord Howe's Island, Australia, Polynesia, and most tropical countries.

75. *Oplismenus setarius*, Rœm. and Sch.

Sunday and Macaulay Islands; common in shaded places. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, and most tropical countries.

76. **Cenchrus calyculatus*, Cav.

Sandy flat on the north side of Sunday Island. Polynesia, from the Sandwich Islands to New Caledonia and Tonga.

77. **Imperata arundinacea*, Cyr.

Cliffs on the north side of Sunday Island; plentiful. Australia, Polynesia, and many other temperate and tropical countries.

78. **Polypogon monspeliensis*, Desv.

Macaulay Island; not uncommon. Not seen on Sunday Island. This is usually considered to be a very doubtful native of the Southern Hemisphere, although Bentham gives it a place in the "Flora Australiensis." Had it been observed on Sunday Island, I should have considered it naturalized; but it is hard to see how it could be carried to Macaulay Island, which has always been uninhabited, and which is perhaps not landed on once in ten years. Temperate and sub-tropical regions of the old world; Australia?

79. *Dichelachne sciurea*, Hook. f.

Macaulay Island; not uncommon. New Zealand, Norfolk Island, Australia.

80. *Deyeuxia forsteri*, Kunth.

Sunday and Macaulay Islands. A few specimens only were seen, but it would probably be more abundant later in the season. New Zealand, Lord Howe's Island, Australia.

81. *Agrostis* ? sp.

A small fine-leaved grass, very plentiful on Macaulay Island, but not seen in flower, is doubtfully referred to this genus for the present.

82. **Eleusine indica*, Gærtn.

Lower portions of Sunday Island, and on Meyer Island; abundant. Australia, Polynesia, and most warm countries.

83. *Poa* sp.

Cliffs of Sunday Island, and everywhere on Macaulay Island. Specimens too immature to determine the species.

84. *Agropyrum scabrum*, Beauv. ?

A doubtful identification, resting on a comparison of the foliage, the plant not being in flower at the time of our visit. New Zealand, Norfolk Island, Australia.

89. FILICES.

85. *Cyathea milnei*, Hook.

Sunday Island; most abundant, from sea-level to the tops of the highest hills. A noble species, attaining 50 feet in height. Endemic.

86. *Hymenophyllum demissum*, Swz.

Sunday Island; chiefly on fern-trunks towards the tops of the hills. New Zealand, Polynesia, Java, Philippines.

87. *Trichomanes venosum*, Br.

Sunday Island; trunks of fern-trees towards the tops of the hills. New Zealand, Australia.

88. *Adiantum diaphanum*, Blume.

Sunday Island; plentiful. Macaulay Island; fringing the sides of a dry watercourse. New Zealand, Norfolk Island, Australia, Polynesia, Malayan Islands, China.

89. *Adiantum affine*, Willd.

Ravines on Sunday Island. New Zealand, Australia.

90. *Adiantum hispidulum*, Swz.

Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, tropical Asia and Africa.

91. *Hypolepis tenuifolia*, Bernh.

Sunday Island, very plentiful; Macaulay Island, rare. The form is that sometimes kept separate under the name of *H. dicksonoides*, Hook. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, Java.

92. *Pellæa falcata*, Fee.

Sunday and Macaulay Islands; common. New Zealand, Lord Howe's Island, Australia, Malayan Islands, India.

93. *Pteris tremula*, Br.

Sunday Island, common; Macaulay Island, rare. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.

94. *Pteris aquilina*, L., var. *esculenta*.

Sunday Island; scarce, and only seen in two localities. World-wide.

95. *Pteris comans*, Forst.

Sunday Island; the most common of all ferns. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, Juan Fernandez.

96. *Lomaria acuminata*, Baker.

Sunday and Macaulay Islands; common. New Zealand—Little Barrier Island, *A. Reischek*; Three Kings Islands, *T.F.C.*; Norfolk Island.

97. *Lomaria procera*, Spr.

Sunday Island; not uncommon. New Zealand, Lord Howe's Island, Australia, Polynesia, South America, South Africa.

98. *Doodia media*, Br., var. *milnei*.

Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Australia, Polynesia.

99. *Asplenium obtusatum*, Forst.

Sunday and Macaulay Islands; common on maritime rocks. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.

100. *Asplenium lucidum*, Forst.

Sunday Island; not uncommon. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.

101. *Asplenium caudatum*, Forst.

Sunday Island; plentiful. Hardly separable from *A. falcatum* as a species. Australia, Polynesia, Malayan Islands, India, South Africa, South America.

102. *Asplenium flaccidum*, Forst.

Sunday Island; plentiful. In addition to the varieties α, β, and γ of the "Handbook of the N.Z. Flora," the form sometimes kept distinct, as *A. shuttleworthianum*, Kunze, is also present. New Zealand, Australia, Polynesia.

103. **Asplenium* (*Diplazium*) sp.

Ravines on Sunday Island; not common. A rather small species, seldom more than 18 inches high, with pinnate fronds. It is evidently closely allied to and may be identical with the Fijian *A. congruum*, Brack. Polynesia?

104. *Aspidium aristatum*, Swz.

Sunday Island; very plentiful. New Zealand—Taranga Isles, *T.F.C.;* Norfolk Island, Australia, Polynesia, tropical Asia, South Africa.

105. *Nephrodium decompositum*, Br.

Sunday Island; common towards the tops of the hills. New Zealand, Norfolk Island, Australia, Polynesia.

106. **Nephrodium tenericaule*, Hook.; *N. setigerum*, Baker.

Ravines on Sunday Island; not rare. Norfolk Island, Australia, Polynesia, tropical Asia.

107. *Nephrodium molle*, Desv.

Sunday Island, in several places in the lower portions of the island. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, and tropical countries generally.

108. **Nephrolepis exaltata*, Schott.

Sunday Island; abundant in Denham Bay, but not seen elsewhere. Australia, Polynesia, and most tropical countries.

109. *Polypodium billardieri*, Br.

Sunday Island; very abundant. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

110. *Polypodium serpens*, Forst.

Sunday Island; plentiful. New Zealand, Norfolk Island, Australia, Polynesia.

111. *Ophioglossum lusitanicum*, L.

A few specimens collected on the large crater of Sunday Island. New Zealand, Australia, and many temperate and tropical countries.

39. LYCOPODIACEÆ.

112. *Lycopodium billardieri*, Spring.

Sunday Island, on the trunks of tree-ferns; rare. New Zealand.

113. **Lycopodium cernuum*, L.

Sunday Island, in the large crater-basin; not common. Universal in tropical countries.

114. *Tmesipteris forsteri*, Endl.

Sunday Island, on the trunks of fern-trees towards the tops of the hills. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.

115. *Psilotum triquetrum*, Swz.

Sunday Island; not uncommon, and attaining a large size. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, and most warm countries.

TABLE SHOWING THE DISTRIBUTION OF THE KERMADEC ISLANDS PLANTS:—

—	Endemic.	New Zealand.	Norfolk Island.	Lord Howe's Island.	Australia.	Polynesia.
Cardamine stylosa	..	x	..	..	x	..
Melicytus ramiflorus	..	x	x	..	..	..
Pittosporum crassifolium	..	x	..	..	..	..
Geranium dissectum	..	x	..	..	x	..
Geranium molle	..	x	..	..	x	..
Oxalis corniculata	..	x	x	x	x	x
Melicope ternata	..	x	..	..	..	..
Corynocarpus lævigata	..	x	..	..	..	..
Coriaria ruscifolia	..	x	..	..	..	..
Coriaria thymifolia	..	x	..	..	..	..
Canavalia obtusifolia	..	..	x	x	x	x
Acæna sanguisorbæ	..	x	..	..	x	..
Haloragis alata	..	x	..	..	x	..
Callitriche verna	..	x	..	..	x	..
Metrosideros polymorpha	..	..	..	x	..	x
Sicyos angulatus	..	x	x	x	x	..
Mesembryanthemum australe	..	x	x	x	x	..
Tetragonia expansa	..	x	x	x	x	..
Tetragonia trigyna	..	x	..	..	x	..
Hydrocotyle moschata	..	x	..	..	..	..
Apium australe	..	x	..	x	x	..
Panax arboreum	..	x	..	..	..	..
Coprosma baueriana	..	x	x	..	..	..
Coprosma petiolata	..	x	x	x	..	..
Coprosma acutifolia	x	..	..	..	..	..
Ageratum conyzoides	..	..	..	..	x	x
Lagenophora forsteri	..	x	..	..	..	..
Lagenophora petiolata	..	x	..	..	..	..
Siegesbeckia orientalis	..	..	..	..	x	x
Bidens pilosa	..	x	..	x	x	x
Cotula australis	..	x	..	..	x	..
Gnaphalium luteo-album	..	x	x	x	x	..
Gnaphalium involucratum	..	x	x	x	x	..
Gnaphalium collinum	..	x	..	..	x	..
Senecio lautus ?	..	x	..	..	x	..
Senecio ? sp.	..	..	..	..	..	..

——	Endemic.	New Zealand.	Norfolk Island.	Lord Howe's Island.	Australia.	Polynesia.
Sonchus oleraceus	..	x	..	..	x	..
Scævola gracilis	x	..	..	..	..	..
Wahlenbergia gracilis	..	x	..	x	x	..
Lobelia anceps	..	x	x	x	x	..
Samolus repens	..	x	x	..	x	x
Myrsine kermadecensis	x	..	..	..	..	..
Convolvulus sepium	..	x	..	..	x	..
Convolvulus soldanella	..	x	x	x	x	..
Ipomœa palmata	..	x	x	x	x	x
Ipomœa pes-capræ	..	..	..	x	x	x
Solanum nigrum	..	x	x	..	x	x
Solanum aviculare	..	x	x	x	x	..
Veronica salicifolia	..	x	..	..	..	..
Veronica ligustrifolia	..	x	..	..	..	..
Myoporum lætum	..	x	..	..	..	..
Rhagodia nutans	..	x	..	..	x	..
Rumex flexuosus	..	x	..	..	..	..
Pisonia brunoniana	..	x	x	x	x	x
Aleurites moluccana	..	..	..	..	x	x
Carumbium polyandrum	x	..	..	..	..	..
Parietaria debilis	..	x	x	x	x	..
Bœhmeria australis	..	..	x	..	..	..
Ascarina lucida	..	x	..	..	..	x
Piper excelsum	..	x	x	x	x	x
Peperomia urvilleana	..	x	x	x	..	..
Acianthus sinclairii	..	x	..	..	..	..
Microtis porrifolia	..	x	..	..	x	..
Cordyline terminalis	..	..	..	..	x	x
Kentia baueri	..	..	x	..	..	..
Typha angustifolia	..	x	x	..	x	x
Cyperus ustulatus	..	x	..	..	..	..
Scirpus nodosus	..	x	x	x	x	..
Carex sp.	..	..	..	..	..	..
Carex sp.	..	..	..	..	..	..
Paspalum scrobiculatum	..	x	..	..	x	x
Panicum sanguinale	..	..	..	x	x	x
Panicum sp.	..	..	..	..	..	..
Oplismenus compositus	..	..	..	x	x	x
Oplismenus setarius	..	x	x	x	x	x
Cenchrus calyculatus	..	..	..	..	..	x
Imperata arundinacea	..	..	..	..	x	x
Polypogon monspeliensis	..	..	..	..	x (?)	..
Dichelachne sciurea	..	x	x	..	x	..
Deyeuxia forsteri	..	x	..	x	x	..
Agrostis (?) sp.	..	..	..	..	..	..
Eleusine indica	..	..	..	..	x	x
Poa sp.	..	..	..	..	..	..
Agropyrum scabrum	..	x	x	..	x	..
Cyathea milnei	x	..	..	..	..	..
Hymenophyllum demissum	..	x	..	..	..	x

—	Endemic.	New Zealand.	Norfolk Island.	Lord Howe's Island.	Australia.	Polynesia.
Trichomanes venosum	..	x	..	..	x	..
Adiantum diaphanum	..	x	x	..	x	x
Adiantum affine	..	x	..	..	x	..
Adiantum hispidulum	..	x	x	x	x	x
Hypolepis tenuifolia	..	x	x	x	x	x
Pellæa falcata	..	x	..	x	x	..
Pteris tremula	..	x	x	x	x	x
Pteris aquilina	..	x	x	x	x	x
Pteris comans	..	x	x	x	x	x
Lomaria acuminata	..	x	x	..	..	..
Lomaria procera	..	x	..	x	x	x
Doodia media	..	x	x	..	x	x
Asplenium obtusatum	..	x	x	x	x	x
Asplenium lucidum	..	x	x	x	x	x
Asplenium caudatum	..	..	..	x	x	x
Asplenium flaccidum	..	x	..	..	x	x
Asplenium sp.	..	..	..	..	..	x (?)
Aspidium aristatum	..	x	x	..	x	x
Nephrodium decompositum	..	x	x	..	x	x
Nephrodium tenericaule	..	..	x	..	x	x
Nephrodium molle	..	x	x	x	x	x
Nephrolepis exaltata	..	..	..	..	x	x
Polypodium billardieri	..	x	x	x	x	x (?)
Polypodium serpens	..	x	x	..	x	x
Ophioglossum lusitanicum	..	x	..	..	x	..
Lycopodium billardieri	..	x	..	..	..	..
Lycopodium cernuum	..	x	..	..	x	x
Tmesipteris forsteri	..	x	x	x	x	x
Psilotum triquetrum	..	x	..	x	x	x

NATURALIZED PLANTS.

Fumaria officinalis, L.
Alyssum maritimum, L.
Capsella bursa-pastoris, D.C.
Senebiera coronopus, Poir.
Senebiera didyma, Pers.
Cerastium vulgatum, L.
Stellaria media, L.
Trifolium pratense, L.
Trifolium repens, L.
Apium graveolens, L.
Daucus carota, L.
Erigeron canadense, L.
Senecio vulgaris, L.
Hypochæris radicata, L.
Physalis peruviana, L.
Nicotiana tabaccum, L.
Plantago major, L.
Plantago lanceolata, L.
Veronica arvensis, L.
Rumex obtusifolius, L.
Euphorbia peplus, L.
Cynodon dactylon, Pers.
Dactylis glomerata, L.
Poa annua, L.
Poa pratensis, L.
Lolium perenne, L.

ART. XXIV.—*On the Naturalized Dodders and Broom-rapes of New Zealand.*

By T. KIRK.

[*Read before the Wellington Philosophical Society, 6th July,* 1887.]

WHILE the subjects of this paper are of exceptional interest to the botanist, as parasitic flowering-plants which obtain the whole of their nourishment from the unfortunate plants which they use as hosts, they are often the cause of serious injury to the farmer, who may find himself compelled to witness the destruction of his crops of lucerne, clover, and flax at the period when he is expecting to reap his richest profits. It is chiefly from this economic point of view that it is intended to regard them in this paper.

The seed of the dodder germinates in the ground, and developes a reddish or purplish thread-like stem, destitute of leaves in all stages of its growth; when the stem comes in contact with a suitable host-plant, it developes minute suckers, which may be termed root-suckers, as they enable it to grasp the plant so firmly that it is impossible to detach it without killing both host and parasite. When suckers are developed the true root dies, having served its purpose; thread-like stems are produced with amazing rapidity, so that the host often appears to carry masses of threads; each short stem developes new suckers, and adjacent plants are speedily involved. If left unchecked the pest will soon destroy the entire crop, as its myriads of root-suckers rapidly extract the greater portion of the assimilated nutriment of the host, which gradually becomes impoverished and dies.

After a longer or shorter period, flowers are produced, sometimes in vast profusion. They are developed in small, globose fascicles, and give rather a pretty appearance to the unfortunate hosts. The corolla is entire, consisting of five petals, alternating with five stamens. At the base of each stamen is a curious scale, which may be lacerated or fringed, or ciliated, and which affords a useful means of distinguishing the species.

Dodders belong to the *Convolvulaceæ*, but differ from their congeners in being destitute of cotyledons, and ultimately parasitic.

THE LUCERNE DODDER.

Cuscuta hassiaca, Pfeiffer.

This species was first observed on lucerne in the Canterbury District. The seed had been imported from California. In some parts of the field it was most abundant, and had extended its operations to the sorrel, knot-grass, and other weeds which grew sparingly amongst the crop. The following season the lucerne was very weak and thin, but there was very little dodder; subsequently the crop died out. The lucerne dodder has been observed in several localities in the Canterbury District.

The Clover Dodder.

Cuscuta epithymum, L., var. *trifolii.*

This was first observed on red clover in the Waikato, in 1870, and still makes its appearance in clover fields in that district, but does not cause so great an amount of damage as in Europe. It has also been noticed in Southland, and in all intermediate districts except Taranaki and Westland. In Southland its ravages are of a serious character, though happily limited to a small area. It is the most destructive species which the agriculturist has to encounter, and is sometimes designated "Devil's guts."

The Flax Dodder.

Cuscuta epilinum, Weibe.

I have been informed that this species was observed in the Canterbury District about three years ago, but have seen no specimens.

Prevention.

Dodders are introduced into cultivation with the seeds of lucerne, clover, flax, and other plants. As the seeds of dodder may easily be recognised, a careful examination of the clover, lucerne, or flax seed by a practised eye will easily determine its presence or absence. It is only fair to say that English-grown seeds are remarkably free from dodder. Seeds from the European Continent usually contain a large percentage. I never saw a sample of Russian flax that was free from dodder, and the same must be said of Californian alfalfa.

When dodder is once established it is not easy to eradicate it. I only know one plan likely to be successful. Mow the affected portions close to the ground, and burn it at once, taking care to char the stumps so as to destroy vitality.

Two species of *Cuscuta* are indigenous to New Zealand: one, *C. densiflora*, is rare, being found only in Marlborough and Otago, in both cases growing on *Fuchsia excorticata*. The other, *C. novæ-zealandiæ*, grows on small herbaceous plants, grasses, fern, and low-growing shrubs. Like its imported congeners it may become a pest to the farmer, as it occasionally kills small patches of grass by exhaustion.

Broom-rapes.

These are erect parasitic plants with succulent simple stems, the upper portions being crowded with sessile flowers; the whole plant being of a lurid brown hue. They are leafless, although a few brown scales are found at the lower part of the stem, and a bract at the base of each flower. The seeds are very small, and produced in great abundance; when germinating they do not rise above the soil, but at once attack the root-fibres of a suitable host plant, and soon become parasitic on the root. When shrubs are attacked the *Orobanche* may be perennial, as the shrub is but slightly affected in proportion to its bulk; but herbaceous plants are speedily exhausted, even red clover being unable to sustain the constant drain upon its resources beyond the second year.

CLOVER BROOM-RAPE.

Orobanche minor, Sutt.

This appeared on red clover, near Cambridge, Waikato, in 1885, and was seen last year in much greater quantity. I observed from three to six stems, 9 to 12 inches in height, springing from a single root of clover, so that it is easy to form an idea of its exhausting effects.

In Europe it is of less frequent occurrence than the clover dodder, and its ravages are less dreaded, but in some seasons they attain serious proportions.

Its appearance in the Colony is to be deeply regretted.

HAWK-BIT BROOM-RAPE.

Orobanche picridis, F. Schultze.

This species was first observed at Whangarei, about 1867, growing on the roots of cat's-ear (*Hypochæris radicata*); curiously enough it is more robust in this Colony than in Europe, and varies in height from a few inches to upwards of 2 feet, and occurs in great abundance. It is often the most prominent plant on grass lands about Whangarei, and begins to flower in October.

Unlike the preceding species, its effects are decidedly beneficial, as it invariably destroys the useless cat's-ear, and allows its place to be occupied by grasses or clovers.

Orobanche picridis has been observed in several parts of the Auckland District and in Nelson, but not, so far as I am aware, in other parts of the Colony; it is nowhere so abundant as in the Whangarei District.

It is a singular fact that in Europe this species does not attack the cat's-ear, but is restricted to *Picris hieracioides*. The *Picris* is not uncommon in the north of New Zealand, but appears to be exempt from the attacks of the parasite, which confines its attention to the unhappy cat's-ear.

There is reason to think that this species might be used as an esculent, if cooked and served in the same way as asparagus. Two species are eaten in this way in Central Asia and Afghanistan.

PREVENTION.

Although the seed is fine, almost dust-like, its presence amongst other seeds may be detected by a careful observer, although not apparent to the untrained eye. When any species of *Orobanche* becomes established, I believe it might be easily destroyed by prompt mowing close to the soil, if the operation be performed before the seed-vessels arrive at maturity; a careful watch should be kept, and any new shoots that make their appearance cut down at once.

Probably *Orobanche ramosa*, the broom-rape of the hemp, would withstand this process, but I know of no other species possessing any great power of resistance.

I may close this short paper by advising agriculturists to purchase their seeds from seedsmen who give a guarantee of the purity of their stock, as in the case of some English houses. At present, comparatively few seeds are grown in New Zealand, but I am sure that any qualified persons, taking up the business of seed-growing with proper means and appliances, would obtain a fair annual return without other protection than the cost of packing, freight and insurance, especially if prepared to give a guarantee of the purity and vitality of their seeds.

ART. XXV.—*Description of a new Species of* Uncinia, *Persoon.*

By D. PETRIE, M.A., F.L.S.

[*Read before the Otago Institute, 8th November,* 1887.]

Uncinia clarkii, n. s.

A SPREADING species, forming a close grass-like sward.

Leaves somewhat shorter than the full-grown culms, grassy, smooth or slightly scabrid at the edges, flat with prominent midribs, $\frac{1}{10}$ – $\frac{1}{4}$ inch wide, 6–9 inches long.

Culms, 12 inches high or less, terete, rather stout, smooth, strongly grooved.

Spikelets, 1½–2 inches long; male portion short; bract short and setaceous or none.

Glumes, closely imbricate, as long as the utricles, lanceolate, acute or sub-acute, membranous, pale-brown, attached more than half-round to the rachis, deciduous, leaving when shed a semicircular cup-like projection below the attachment of the utricles, which gives the rachis a curious jointed appearance; male glumes more persistent.

Utricles, small, dark-brown, stipitate below and tapering above, half as long as the recurved bristle, strongly divaricating when mature, faintly nerved on the outer surface.

Hab. Eweburn Creek, Naseby, 2,000 feet; Hector Mountains, 3,000 to 5,000 feet; Mount Tyndall, 3,000 to 4,000 feet.

This species has pretty close affinity to *U. compacta*, Br. It is easily distinguished by its spreading habit, longer spikelets, small dark-brown and strongly divaricating utricles.

The plant ascends the mountains to a height of 5,000 feet or more, becoming smaller and smaller as the height increases. Many specimens in the higher valleys of the Hector Mountains do not exceed 2 inches in length.

I have long been convinced of the independence of this species, but have found it most difficult to satisfy myself on the point. The extant descriptions of the New Zealand forms are very imperfect and sometimes contradictory, and the genus badly needs working out afresh. I have much pleasure in dedicating the species to C. B. Clarke, Esq., F.R.S., F.L.S., who has most kindly compared it with the types in the Kew Herbarium, and supplied me with much valuable information about the New Zealand species.

ART. XXVI.—*Rate of Growth of Transplanted Trees.*

By J. BAKER, C.E.

[*Read before the Auckland Institute, 29th August,* 1887.]

No. III.[*]

PROFESSOR KIRK suggested that it would be well to record the growth of the kauri and other native transplanted trees in the Auckland Domain during the lifetime of the planter.

These trees were planted in the year 1865 by Mr. Chalmers, formerly head caretaker of the domain, now resident at Whangarei. The height of three kauris measured are 22ft., 24ft., and 29ft.; circumference of bole 2 feet from the ground, 2ft. 1in., 2ft. 8in., and 2ft. 2in. respectively.

As a period of fifty years is short enough to deduce from observation a reliable datum as to the profitable value of kauri-planting, it is to be hoped that the restless spirits who preside over alteration and improvement will spare these trees till the year 1915.

The sprigs from these kauri trees, plucked in this month of August, the end of our winter, have on them male and female blossoms, immature cones, and leaflets, showing that the trees are in the vigour of growth. The kauri grows in the latter part of the winter, a fact to be regarded in felling, if the non-growing season be the proper time to fall timber.

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[*] See "Trans. N.Z. Inst.," vol. xviii., p. 311.

Rimu has overtopped the other native pines, owing to favourable situation.

Totara comes next to rimu; then follow tanekaha and miro.

As I said in 1885, the period is too short to form an opinion as to relative profitable values. These records are data for others to work upon.

A writer in the "New Zealand Herald" suggested that information as to the Norfolk Island pines growing in Official Bay, Allotment 12, Section 7, Auckland, should be given.

These trees were planted under the care of the late Rev. Walter Lawry, Superintendent of the Wesleyan Mission, about the year 1844 or 1845. The height of the tallest is 81 feet; girth of bole 2 feet from the ground, 8 feet.

The growth of this is outdone by one growing in Mr. Brookfield's grounds, Allotment 10, Section 84, Onehunga, planted in 1852 by Sergeant McMahon, of the N.Z. Fencibles, for Dr. Mahon, senior surgeon of the same force.

This tree, standing by itself on level ground, conspicuous all around Onehunga, is the most handsome transplanted pine in the neighbourhood of Auckland. It has attained during thirty-five years a height of 89 feet, with a circumference of 9 feet, 2 feet above the ground.

Of the value of the timber of the Norfolk Island pine I have not been able to obtain information.

TABLE of RATE of GROWTH of TRANSPLANTED TREES.

NAME OF TREE.	Height in feet.		Circumference 2 feet above the ground.		Age.	SITUATION.	PLANTER.
	ft.	in.	ft.	in.	Yrs.		
Kauri, average of 3	25	0	2	2	22	Auckland Domain	Chalmers.
Totara " "	28	4	1	11	22	"	"
Rimu " "	31	0	2	3	22	"	"
Tanekaha " "	22	8	1	5	22	"	"
Miro	16	0	1	2	22	"	"
Norfolk Island Pine	81	0	8	0	42	Allot 12, Sec. 7, Auckland.	Rev. W. Lawry.
Do. do.	89	0	9	0	35	Allot. 10, Sec. 84, Onehunga.	Sergt. McMahon N.Z. Fencibles.

NOTE.—In the table, vol. xviii., page 314, the age of the kauri is given as 16 years; Mr. Chalmers, the planter, informs me that it was planted in 1865, consequently it should have been 20 years old, not 16.

Art. XXVII.—*On new Phænogamic Plants of New Zealand.**

By William Colenso, F.R.S., F.L.S., etc.

[*Read before the Hawke's Bay Philosophical Institute*, 12*th September*, 1887.]

Class I.—Dicotyledons.

Order I.†—RANUNCULACEÆ.

Genus 3. **Ranunculus**, Linn.

1. *R. reticulatus*, sp. nov.

Plant a dwarf tufted perennial, 2–3 inches high. Root-stock thick, 1 inch long, ½ inch diameter, composed of many old and loose coalescent petioles; roots several, long, stout, spreading. Leaves few, all radical, erect, spreading, thickish, light-yellowish-brown or tawny-yellow and glabrous on the upper surface, yellow beneath with long silky scattered white hairs, orbicular-reniform, 1¼–1½ inches broad, 8–9 lines long, petiolate, basal sinus very large, 3-parted; segments flabelliform, spreading, cut to base, ¾ – 1 inch wide at top, very narrow (sub 1 line) at base; sinuses very large and open; each segment sub 3 – 4-lobed; lobes deeply cut (⅓), outer margins coarsely crenate-serrate; teeth very obtuse; veins yellowish-brown, sunk, obscure, rather distant, anastomosing; veinlets dark-brown, numerous, largely reticulate, compoundly anastomosing throughout the whole leaf, extending into the smallest teeth. Petioles 1–1¼ inches long, stoutish, channelled above, coarsely striate, very hairy; hairs long, white, patent; largely dilated at base into a kind of loosely sheathing glabrous stipule, auricled upwards, margins very membranous.

Hab. Sides of Mount Ngaruahoe, "altitude 3,000 feet," County of East Taupo; 1887: *Mr. H. Hill* ("apparently scarce").

Obs. I. A peculiar (and, as far as I know, a unique) species, differing widely from all its congeners; perhaps its nearest ally is *R. pinguis*, Hook. f., which is said in "Handbook Flora N.Z." to have "veins reticulated;" (though such is not stated in the very long and minute description of that species given in "Flora Antarctica," vol. i., p. 3; neither is any such character shown in the large plate containing several specimens of that plant with dissections in the accompanying drawing in that work;) but this plant is also widely different from *R. pinguis* in several other characters. Its main veins are irregular with copious areolæ between them with free clavate veinlets, somewhat like what obtains in the venation of *Polypodium billardieri.*

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* Mounted specimens of the plants herein described were exhibited at the meeting.

† The numbers attached to the orders and genera in this paper are those of them in the "Handbook, Flora of New Zealand."

II. Of this plant I have received three entire specimens, in leaf only, but evidently mature and old from their thick root-stocks; one (the largest) has 8, one 4, and one (the smallest plant) 6 leaves; the plants are pretty nearly alike. Unfortunately I have not seen any flowers or fruit, nor any old vestiges of the same; but the peculiar shaped and striking reticulated leaves have induced me to describe it and make it known.

ORDER IV.—VIOLARIEÆ.

Genus 2. **Melicytus**, Forst.

1. *M. microphyllus*, sp. nov.

Female.—Free, small, and slender, much like the male plant described,[*] trunk bare, erect, once forked at 6 feet from the ground; young branchlets very long and slender, almost filiform, dark purple, finely puberulous. Leaves few and scattered, as in male plant, but smaller, usually 2–3 (rarely 4) lines long, base sub-truncate; petioles 1–1½ lines long. Flowers rather numerous, scattered, small, scarcely 1 line diameter, axillary and lateral, solitary, sometimes 2 (very rarely 3) together; peduncles short, about 1 line long, puberulous and bibracteate; bracts deltoid, brown, scarious, laciniate, with several similar stipellæ at base. Calyx persistent, dark purple, thickish; lobes 5, broadly oblong, with produced membranous brown laciniate-fringed tips; petals 5, sub-orbicular-oblong, white, with a delicate greenish tinge, sometimes purple-streaked, margins thickened and incurved, tips finely laciniate-ciliate, recurved; anthers 5, sessile, small, alternate with petals, sub-orbicular, with 2 minute erect horns at tip of connective, and a fleshy scale at back; style short, thick; stigma large, depressed, spreading, somewhat irregular, papillose or sub-rugulose, usually with 3 acute angles, their tips brown and incurved; ovary large, oblong, sub-cylindrical. Berry 2½ lines long, 1½ lines broad, oblong-ovoid, obtuse, dark-purple, smooth, a little fleshy; stigma and calyx persistent. Seeds 2, ovoid, 1½ lines long, largely gibbous on one side, the other flat, glossy, purple-spotted, one edge raised and thickened, tip a little incurved, sub-acute.

Hab. On the banks of a small stream in a forest south of Danneverke, County of Waipawa; February, 1887: *W.C.* (But only one tree seen; bearing ripe fruit, in May.)

Obs. The discovery of this plant pleased me much, as it served to confirm the validity of the species. In my description of the male plant (in vol. xix.), I had mentioned it being very near to *M. micranthus*, Hook. f., though with larger flowers and smaller leaves, etc.; the female plant, however, differs more largely and materially, particularly in the peculiar shape of its stigma, and in its much larger and differently shaped berry. I was too early for mature fruit in February, for while there were plenty of flowers, only a very few young berries were detected. Ripe fruit, however, were obtained early in May from the same tree; which, though adhering firmly, and not beginning to shrivel, were but few in number, and much scattered; only in one instance did I detect two growing together.

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[*] "Trans. N.Z. Inst.," vol. xix., p. 260.

ORDER XXVII.—HALORAGEÆ.

Genus 4. **Callitriche**, Linn.

1. *C. microphylla*, sp. nov.

Plant prostrate, tender, delicate, light-green. Stems very slender, 6–12 inches long, branched, rooting at nodes. Leaves opposite rhomboidal, ½–1½ lines long, usually broader than long, obtuse with a slight point, the larger and upper leaves with a single tooth at lateral angle (sub-ivy-leaf-shaped); veins 3–5 (tri-sub-quintupli-nerved), but returning circularly to midrib and not running to tip; petioles length of leaves. Flowers: Male and female together in axil, solitary; peduncle very short, bracts 0. *Male:* stamen short, much shorter than fruit; anther minute, sub-trilobed, brown. *Female:* style short; stigmas 2, short, obtuse. Fruit rather large, light-brown, obcordate, emarginate, sinus deep, base truncate, double-winged all round margins; wings crisped, shining, very membranous, whitish; style persistent; seeds narrow, oblong, turgid.

Hab. On the ground in forests, forming thickish beds; and also in watercourses, in open lands near Danneverke, County of Waipawa; 1887: *W.C.*

Obs. I. This plant appears to be very distinct from the known published New Zealand species of this very small genus, (*C. verna*, Linn., and *C. verna*, *β*, Linn., or *C. stagnalis*, Scopoli,) also from those other British and European species, *C. pedunculata*, and *C. autumnalis*, which, with one other North American species, *C. terrestris*, compose the genus. From Sir J. D. Hooker's remarks on *C. verna* and its varieties, as severally and exhaustively given by him in his "Botany, Antarctic Voyage,"* this plant, as a species, seems to be wholly separate. I know it is from *C. verna* and its var. *β*, as found here in New Zealand, as I myself had early collected and sent specimens of those plants to Kew.

II. All the described species and varieties of *Callitriche* have their two stigmas very long acuminate and acute,† without a style, and the stamen much longer;* but in this plant the opposite is the case, besides its minute, very peculiar, and angled upper leaves, with their different venation.

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* Vol. i., p. 11; vol. ii., p. 272; vol. iii., p. 64; and vol. v., p. 124.

† "Half-inch long and upwards;" *teste* Hooker, *l.c.*, vol. i., p. 12.

III. I may further observe that the finer specimens of this plant I found growing on the land in the woods, and not in watery places or in water; and when found in water the tips of the upper branches did not possess that crowded sub-rosulate appearance which is so common with *C. verna*.

ORDER XXXIII.—UMBELLIFERÆ.

Genus 1. **Hydrocotyle**, Linn.

1. *H. echinella*, sp. nov.

Plant rather small, 5–6 inches long, procumbent, straggling, weak, branched; stems (and peduncles) compressed flat; the whole plant hairy; hairs on stems curved, hyaline, sub-jointed: on leaves, strigose, thick, white. Leaves few, distant, scattered, orbicular, ¼ inch diameter, with a large spreading basal sinus, sub-membranaceous, dark-green, 4 – 6-parted; nerves 6, segments broadly obovate-cuneate, cut half-way to base, their sinuses open, rounded, margined; each segment sub-3-lobed; lobes 3 - 4-toothed; teeth acute, mucronulate. Petioles 1 – 1¼ inches, slender, filiform, flexuous. Stipules small, sub-orbicular, membranous, nerved, laciniate-toothed; teeth erect, acute, and mucronate. Peduncles very much longer than leaves, very slender, flexuous, weak, 3 inches long; pedicels sub-20, 1½ lines long, slender, patent. Involucral leaves many, small, narrow lanceolate, mucronate. Fruit small, orbicular, sub ½ line diameter, turgid, slightly cordate at base, brownish, densely echinate; carpels with one prominent rib on each face, their back-edge obtuse and partly concealed with the echinate hairs; styles long, divergent.

Hab. Among herbage, woody glen, base of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

Obs. I. This little species differs considerably from all its known New Zealand congeners (and from all others known to me); the great length of its filiform peduncles and their being (together with the stems) compressed flat, and its densely echinated fruit, are peculiar and conspicuous characters, as also its leaves and stipules, in their many sharply acute mucronate teeth, and the margined sinuses of the leaves.

II. Unfortunately I have had but *one* imperfect specimen without flowers, and that not in very good condition, to examine; and I should not care to describe the plant were it not for its striking characters.

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* "Stigmas 2, long, filiform;" *l.c.*, vol. iii., p. 64.

ORDER XXXIV.—ARALIACEÆ.

Genus 2. **Panax**, Linn.

1. *P. integrifolia*, sp. nov.

A small glabrous straggling shrub, 5–6 feet high, with a close rounded top. Branches (specimens) straight, stoutish, 4–5 inches long, scarred below, much branched and bushy at top; branchlets small and slender, close, bark black. Leaves very numerous, crowded, oblong-lanceolate and narrow obovate-lanceolate, tapering, ¾–1½ inches long, but usually about 1 inch or less, jointed, petiolate, tips sub-acute, recurved, mucronulate, thickened; sub-membranaceous inclining to coriaceous, green, paler and longitudinally wrinkled on lower surface, glabrous but not glossy, midrib and veins obscure, margins entire, sometimes (but rarely) a leaf is slightly serrulate with 1–2 very small teeth near apex, a few leaves bifoliolate and also trifoliolate, and when so the leaflets are sessile, divergent, and entire; petioles slender, mostly ½–¾ inch, longer when the leaf is compound. Stipules 0, but small subulate acute stipellæ at bases. Umbels simple, terminal and axillary, on erect peduncles 1 inch long, about 14-flowered; rays ¼ inch, patent, bibracteolate about middle; bracteoles deltoid, scarious, very small; 2 bracts at base thick, obtuse; involucral leaves very small sub-linear. Fruit sub-orbicular, broader than long, 2 lines diameter, compressed, dark olive, glossy, coriaceous, sunk and corrugated transversely between carpels; calycine teeth stoutish, acute, recurved; styles 2, recurved, divergent.

Hab. Base of Mount Ruapehu, County of East Taupo; "altitude 5,400 feet;" 1887: *Mr. H. Hill.*

Obs. I have received several specimens of this plant, but all past flowering. It does not appear to be closely allied to any of our New Zealand (and South Pacific) species; perhaps it approaches more nearly in a general way to *P. simplex*, Forst., and to *P. sinclairii*, Hook. f.

ORDER XXXVIII.—RUBIACEÆ.

Genus 3. **Galium**, Linn.

1. *G. triloba*, sp. nov.

Plant prostrate, light green. Stems many, 2–3 feet (or more) long, slender, weak, scaberulous, channelled, tetragonous, angles sharp or slightly sub-winged. Leaves few and scattered, distant in whorls of 4 on the main stem (sometimes 3, and on ultimate branches only 2, and very small), linear-lanceolate, ½ inch long, 3-nerved, scaberulous on margins and midrib, tips acute and obtuse. Flowers very minute, in long open lax axillary panicles, 3–6 inches long, bearing filiform sub-panicles (or peduncles) 1–2 inches long, of 3 (rarely 4) fasciculated pedicels, each sub ¼ inch long, with two small opposite bract-like leaves at their base; corolla cream-coloured, trilobed; lobes broadly-ovate or deltoid-rotund; tips sub-acute, their upper margins slightly fringed tubercular, with a strong central nerve, and a coloured intra-marginal nerve-like line. Fruit sub-globose, minutely papillose (*sub lente*), dark-coloured, nearly black.

Hab. Edges of streamlets in dense shaded woods near Danneverke, County of Waipawa; 1887: *W.C.*

Obs. This species is rather peculiar from its very small trilobed corolla with tuberculate margins, and its thickly entangled habit of growth, forming thick beds. It may, however, prove to be a southern variety of A. Cunningham's northern New Zealand species, *G. tenuicaule;* of which only an imperfect description (omitting its flowers) is given by him in his "Prodromus;" while Hooker f., in his "Handbook," merely says in addition, of the corolla of that species: "Flowers white, $\frac{1}{16}$th inch diameter."

Order XXXIX.—COMPOSITÆ.

Genus 1. **Olearia**, Mœnch.

1. *O. xanthophylla*, sp. nov.

A small, low, diffuse, much-branched shrub, "1 foot 6 inches high;" branchlets erect, 2–4 inches long, simple, rather slender, glabrous, yellow (as are the leaves beneath) with dry gummy exudation. Leaves numerous, small, closely imbricated and adpressed, somewhat sub-decussately arranged, obovate-spathulate, 3 lines long, 1¼ lines broad at widest, obtuse, coriaceous, entire, glabrous with a few weak woolly hairs at tips; brownish on the upper surface, bright yellow (almost orange) on the lower and covered with a thick yellow scurf or gum very closely adhering, corrugated, the midrib stout; margined, the margin thick, dark-brown with a shining gummy appearance; petioles thick, dilated and rugulose at base. Flowers terminal at tips of branches, in thick globular compact corymbs, ½–¾ inch diameter; heads small, obconical, 2 lines diameter, containing about 9 florets; peduncles 2 lines long, grooved, bi-bracteolate; bracteoles opposite, small, ovate, acute, spreading, woolly (as also pedicels); pedicels ¼ line long with 1 small bracteole at base of head; the outer involucral scales imbricate in 2 rows (inner row longest), pale yellowish-brown, sub-scarious, loosely silky, edges very membranous, tips obtuse and irregularly cut; the inner scales, tips pure white, much laciniate, recurved, their lateral margins serrulate, slightly and loosely woolly, base bifid. Pappus few, white, short, equal, a very little longer than florets, thickened and dilated at tips. Achene small, sub-cylindrical, slightly grooved, dilated at base, glabrous.

Hab. High plains, Waimarino, west side of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

2. *O. hillii*, sp. nov.

A small stout erect glabrous bushy shrub, "12–18 inches high"; branches thick, many, the upper portions very leafy, the lower scarred; branchlets dark-coloured, grooved, shining, gummy. Leaves small, numerous, close, sub-adpressed and sub-imbricate, elliptic, elliptic-orbicular and obovate, 1½–3 lines long, entire, petiolate; tips rounded with a few loose scattered woolly hairs, also about margins; the upper surface brown, reticulated and glossy; the lower pale primrose-colour, with dry gummy scurf, mid-rib very dark-coloured; margins thickened and recurved; petioles dark-coloured, channelled, shining, sub-½ line long, those of obovate leaves tapering, those of elliptic, etc., suddenly formed. Flowers sub-terminal in single axillary heads; peduncle slender, ½ line long; heads campanulate, sub-½ inch long, 3–4 lines broad, each containing about 7 florets; involucral scales in 4 rows, glabrous, shining, tipped and margined with dry gummy exudation; the inner longest, narrow, linear-lanceolate, 1-nerved, sub-acute; the outer broader and sub-ovate; margins and tips slightly hairy and ciliate. Pappus reddish-brown, long, spreading, equal, very slender below; tips thickened and much serrulate, somewhat bushy. Achene long, slender, sub-cylindrical, irregularly uneven, dark-brown with black nerves, glabrous, with a very few scattered white hairs near base, and sometimes forming a single broken longitudinal line.

Hab. High plains, Waimarino, west side of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

3. *O. rigida*, sp. nov.

Shrub, "2 feet high," diffuse with a rounded dome-like top; branches (specimens) 3–5 inches long, very stout (as thick as a common-size lead pencil), rigid, densely clothed with closely-adpressed greyish wool. Leaves numerous, opposite, very thick and rigid, almost sub-woody, regularly elliptic, usually about 1 inch long, sometimes on same branchlet only ½ or ¼ inch, often concave, abruptly joined to petiole, not narrowed or tapering, tips recurved; glabrous, glossy, reticulated and rugulose, dark-olive and greenish-brown on the upper surface; densely pilose on the lower with short closely-adpressed light-reddish-grey hairs; margins entire and much thickened, narrowly and regularly woolly on the upper rim; petioles long, 3–7 lines, varying with the sizes of leaves, stout, channelled, and densely pilose, their bases very thick, dilated, clasping. Flowers terminal, corymbose at tips of branches; corymb sub-rotund, 1–1½ inches diameter, rather loosely branched in sub-panicles of 3 heads, the base closely surrounded with leaves; heads small, turbinate, spreading, 3 lines diameter, containing sub 20 florets; pedicels 2 lines long, very stout, woolly with a small bracteole; wool faint dingy yellowish-white with a tinge of red. Involucral scales in sub 2 series of 8 spreading scales, alike, very thick, rigid, oblong, very obtuse, concave deeply grooved, densely woolly without, glabrous within, tips and margins incurved. Pappus white, very short (length of achene), unequal, wavy, irregular, scabrous throughout and not thickened at tips. Achene rather long, 1½ lines, slender, linear, curved, grooved, glabrous, striate, brown.

Hab. High plains, Waimarino, west side of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

Genus 13. **Raoulia,** Hook. fil.

1. *R. albo-sericea,* sp. nov.

Plant perennial, small, prostrate, 8–10 inches long, spreading stems slender, leafy, woody, reddish-brown, rooting; roots very long and fibrous; much and irregularly branched; branchlets sub-ascending, 1–3 inches high, glabrous. Leaves numerous, close, not imbricate save at tips, opposite, sub-decussately arranged, close and ascending above on branchlets, distant and patent below, linear-spathulate or -rotund, 1½–2 lines long including petiole, lamina spreading and folded (conduplicate), tips largely rounded, 1 line broad, pure white, silky, the glossy hairs closely adpressed, more so on the outside than on the inside (upper surface), where they only form a small semicircular spot at tip; petioles as long as lamina, adpressed, linear, very broad, glabrous, brown, 3-nerved, nerves dark, amplexicaul, their bases overlapping. Heads (few seen) single, terminal on lateral branchlets, small, half-concealed among the leaves. Involucral scales in 2 (sub 3) rows, glabrous, glossy, brownish, 1-nerved, lateral margins hyaline, largely dilated; the outer linear, tips much and deeply laciniate; the inner linear-spathulate, tips retuse and emarginate, slightly crenulately notched, recurved, florets few, sub 6–8. Pappus very few (sub 8 to achene), white, slender, upper part scaberulous, the lower slightly and distantly so, tips acute. Achene glabrous, minutely striate, olive-coloured, slightly tapering and angular, base a little produced and pointed.

Hab. On the dry lower slopes of Mount Ngaruahoe (Tongariro Range), "altitude 5,300 feet," County of East Taupo; 1887: *Messrs. Hill and Owen.*

Obs. I. This interesting little species belongs to Hooker's 1st subsection,* and is pretty closely allied to two of his species there described—*R. australis* and *R. munroi* (but with more of the habit of a third species, *R. tenuicaulis*); it differs, however, from them in habit and in dimensions, in the shape, size, colour, and silkiness of its leaves and involucral scales, and especially in the fewness of its pappus hairs.

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* "Handbook New Zealand Flora," p. 148.

II. Only three heads of florets were found on several specimens that were collected, and these were much advanced, with the florets of the one dissected gnawed by insects; the other parts of the head, however, were perfect.

ORDER XL.—STYLIDIEÆ.

Genus 1. **Forstera**, Linn.

1. *F. truncatella*, sp. nov.

Plant small, herbaceous; stem stout, erect, simple, 2½–4 inches long, red, succulent, ½–1½ inches of the basal portion bare of leaves and scarred, with many simple fibrous rootlets, the upper portion leafy. Leaves light-green, close-set, imbricating, sessile, semi-amplexicaul, 3 lines long, obovate-oblong, thickish, obsoletely veined (seen when held up between eye and light), margins narrowly cartilaginous, a circular green pore at tip within margin upper surface, which becomes dark-brown in age. Scape 2 inches long, filiform, red, erect, 1 – 2-flowered; bracts, on 2-flowered specimens, 6–7, on 1-flowered specimens, 4–5, linear, truncate, 1-nerved, nerve strong, simple; tips ciliate. Calyx large, 4–5 lines long, 6-lobed; lobes oblong, suddenly acuminate, tips truncate, strongly nerved, nerve branched, branches diagonal, short, straight; margins glandular-ciliate. Corolla ½ inch diameter, membranaceous, slightly waved, much veined; veins flexuous and branched; tube short; lamina 6-lobed, cut nearly to base; lobes oblong somewhat broader near apex, spreading, the upper half white, the lower reddish; tips rounded, sub-retuse; margins uneven, tubercular-ciliate. Style erect, divided at base; anthers and stigma exserted.

Hab. Banks of a small mountain stream on the west side of Mount Ngaruahoe; "altitude 5,200 feet;" County of East Taupo; 1887: *Mr. H. Hill.*

Obs. I. A species allied to those three New Zealand species already described, ("Flora New Zealand,") but differing from them all in several particulars; especially in its larger membranaceous flowers with glandular and tuberculate-ciliate margins to both corolla and calyx, which are also much veined, and in the tips of the calycine lobes, and of the bracts, being much truncate.

II. I have received but a few perfect specimens in flower of this interesting little plant, and as I have only dissected one flower (taken from a 2-flowered scape), my description is not so complete as I could wish it to be; it is, however, quite correct as far as it goes: there were just as many 2-flowered as 1-flowered scapes in the lot.

Genus 4. **Oreostylidium**, Berggren.*

1. *O. affine*, sp. nov.

Plant very small, short, cæspitose, densely tufted, 1–1¼ inches high, erect; stem 0; roots long, fibrous, from bases of leaves. Leaves radical ¾-inch long, ½ line wide, rather thickish, linear-subulate with a slender mucro, concave on one side, dilated at base, glabrous, margins entire, green, yellowish and sub-rigid in age. Scape slender, erect, ⅛ inch high, with a broad foliaceous bract about the middle, glandular-hairy (as also the calyx and ovary), hairs tipped with globular black heads. Flower single, at top of scape; calyx erect, stout, very broad (nearly as broad as ovary), margin irregularly lobed; lobes ? 6. Corolla, etc., not seen. Ovary large (for plant), 1½ lines long, oblong, sub-cylindrical, tapering and jointed on to scape.

Hab. In swampy ground at west base of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

Obs. I. This plant resembles *Oreostylidium subulatum*, Berggren, as carefully drawn by him;† (which is also the "*Stylidium? subulatum*, n. sp.," of Hook. f., as given by him with doubt, from his imperfect specimens, in the "Handbook N.Z. Flora," p. 168;) and it would be by me referred to that species were it not for its differential characters—viz., its long and bracteated scape, its broader calyx, with, probably, the larger number of its lobes, its differently-shaped ovary, and its mucronate leaves; none of which characters are given or mentioned by either Hooker or Berggren—in fact, they both give the opposite; and this plant has, also, no long proliferous runners as is shown in Berggren's figure. Unfortunately, the few fruiting specimens I have (three together) were all defective in the margins of their calyces, as if gnawed by some insect, and there was a similar large hole in one of their ovaries, and no corollas; the other parts of the plants were perfect.

II. Curiously enough, Berggren gives "locis uliginosis ad montem Ruapehu," as one of the places in New Zealand (and the only one in the North Island), where he had detected his little plant; and this place is very near the locality where Mr. Hill found his specimens.

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* *Oreostylidium*, gen. nov., Berggren. Of this he says: "A *stylidio* differt hoc genus corollæ laciniis conformibus, columna brevi erecta, stigmate latiore, capsula indehiscente." *Stylidium*, proper, is a very large Australian genus, containing nearly 100 species.

† In his carefully-executed work on some of our New Zealand plants, and mostly *species novæ* discovered by himself—which, unfortunately for me (for us?) is written mainly in the Swedish language—entitled, "Nagra nya," etc. And in mentioning this work here, I must not omit to thank Dr. Berggren for it, and particularly for its most elaborately and exhaustively prepared and beautifully executed plates of plants with their dissections.

ORDER XLII.—ERICEÆ.

Genus 1. **Gaultheria**, Linn.

1. *G. divergens*, sp. nov.

Shrub "2 feet 6 inches high," erect, much branched; branches 6–8 inches long, slender; branchlets finely and sparsely pubescent, with scattered long rigid stout adpressed sub-spinous hairs, glabrous and shining; extending, also, on midrib of leaves below; the young branchlets with scattered long simple linear adpressed leaf-like bracteoles, which are fugacious. Leaves alternate, numerous, sub-erect, flat, oblong and broadly lanceolate, usually 8–9 lines long, sometimes (but rarely) only 3–4 lines, coriaceous, largely reticulated on both sides, the upper surface sub-rugulose, varnished, glossy, reddish-brown; margins thickened, finely serrate-mucronate; petioles short, stout, pilose, 1 line long. Flowers in simple terminal and sub-terminal loose axillary racemes, 2 inches long, distant, spreading; peduncles and pedicels pilose; pedicels slender, curved, 3 lines long, bibracteate as well as having bracts at their bases. Calyx much corrugated at base; lobes large spreading, cut nearly to base, narrow ovate-acuminate very acute, sub-membranaceous, 3-nerved, margins entire. Corolla not seen, past flowering. Capsule small, dry, erect (not depressed), sub-poculiform, 5-angled; style dark-red, long, stout, erect, 1 line long, persistent, minutely puberulent near tip; stigma depressed, slightly capitate.

Hab. On the slopes of Mount Tongariro, west side, County of East Taupo; 1887: *Mr. H. Hill.*

Obs. A species allied to *G. rupestris*, Br., (of which I have two large drawings with dissections,*) but differing widely in its margined leaves, in its long and pilose bibracteate pedicels, in its long narrow free-spreading and entire calycine lobes, and in its fruit not being depressed but erect like a small gun-cap.

Genus 4. **Leucopogon**, Br.

1. *L. heterophyllus*, sp. nov.

Plant low, shrubby, diffuse, spreading, much branched; branches slender, erect, 4–8 inches high, leafy; young ones pubescent. Leaves imbricate, small, 1–1½ lines long, of various shapes and sizes—oblong, narrow-oblong, ovate, and elliptic; tips thickened and very obtuse, concave, glabrous, shining, coriaceous, 3 - 5-nerved, striate below, pale green, narrowly margined; margins finely ciliate; petioles red, glossy, those of the narrow leaves slender, ¼ line long, not dilated at base, increasing in length at tips of branches around flower, those of the wider and smaller leaves very short, broad, dilated and sub-amplexicaul. Flowers few (seen), small, terminal, solitary, sessile; bracts very small; calycine lobes ovate, nerved, striate; margins membranaceous, ciliate. Corolla tubular, 2 lines long, red, glabrous on the outside; lobes 5, narrow, sub-linear-ovate, one-third length of tube, slightly spreading, densely bearded within with white wool. Anthers oblong, wholly enclosed in top of tube; style capitate, stout, nearly half the length of tube. Drupe globular, rather large, 2 lines diameter, dark-pink-red; style persistent.

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* Viz., A. Richard, "Flora N.Z.," tab. 27; Hook. fil., "Flora N.Z.," tab. 42.

Hab. "On the arid lava-flow, among scoria, etc., altitude, 3,000 to 4,000 feet," western slopes of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

Obs. Of this plant I have only seen three flowering specimens, each specimen though much branched bearing only a single flower. I suspect the true flowering season was long past, and though I had several leafing specimens, two only bore fruit,—a single drupe on each! It is, however, very distinct from the other known New Zealand species, and may possibly prove to be identical with one of the many described Australian ones; to some of them it evidently approaches very closely.

Genus 6. **Epacris**, Smith.

1. *E. affinis*, sp. nov.

Plant shrubby; branches slender, close, ascending, 9–10 inches high, leafy from near base; branchlets pilose. Leaves dusky-olive-green, numerous, imbricate, sub-adpressed, ½–2 lines long, mostly broadly ovate, sometimes sub-rhomboidal and orbicular-oblong, obtuse, coriaceous, smooth, shining, keeled; tip thickened; margin slightly incurved; petioles very short. Flowers numerous in corymbs at tips of branches; pedicels short, 1 line long; bracts broadly ovate and (with calyx lobes) 1-nerved, striate; calyx lobes ovate, margins finely ciliate, incurved. Corolla lobes wavy, rather long, rounded, obtuse, much recurved, red-brown; anthers large, oblong, exserted, dark-red; filaments curved. Seeds very small, triangular, smooth, edges thickish, obtuse, yellow-brown, flattish on one side and gibbous on the other.

Hab. "On the arid lava-flow, altitude, 3,000 to 4,000 feet," western slopes of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

Obs. This species is nearly allied to *E. alpina*, Hook. f., (discovered by me in the same mountainous region,) but differs in its more close habit, its smaller adpressed and variable leaves, its narrower and ciliated bracts, and its corymbose flowers. In this last character (rather unusual in the genus) it approaches

E. corymbiflora, Hook. f., a Tasmanian species. It flowers plentifully; but my specimens had long passed flowering, and I have (after a careful search) only seen two flowers, which appeared remarkable for their large exserted anthers. Better specimens, however, are much wanted.

Genus 8. **Dracophyllum**, Lab.

1. *D. rubrum*, sp. nov.

A small shrub of (apparently) erect growth. Branches, 8–4 inches long, slender, erect, greyish, scarred; branchlets ½–1 inch long, very slender, distant and 1–2 together, erect, red-brown, glabrous, ringed, 10–14 leaves at tips. Leaves rigid, erect and sub-recurved, imbricate and sheathing at bases, 1 inch long, subulate, ½ line wide at widest part near dilated base, which is 2 lines wide, sub-quadrate, and many-nerved, very narrow and half-terete at top (not keeled), tip obtuse, margins finely and closely serrulate; the lower ⅔ of leaf canaliculate above and suddenly stopped, the leaves deeply marked (bass-relief) with 2–8 impressions of the leaves in their growth; margins of dilated sheathing portion finely ciliate. Flowers terminal in close sub-corymbose heads or broad short spikes of 9 flowers, shortly pedicelled; floral bracts shorter than flowers, deltoid, 2½ lines long, 2½ lines wide at base, amplexicaul, many-nerved; margins ciliate; tips thickened, obtuse. Calycine leaves much shorter than corolla-tube, ovate, acute, glabrous, veined, margins ciliate. Corolla orange-red, 8 lines long, 2½ lines diameter; lobes deltoid, tips thickened, incurved. Anthers broadly-oblong-ovate, tip truncate. Hypogynous scales obovate-oblong, truncate. Style short, stout; stigma capitate. Capsules (immature) very small at bottom of tube.

Hab. High lands, base of Mount Ruapehu (Tongariro Range), County of East Taupo; whence specimens were brought by a visitor and given to me (with some others) in 1879.

Obs. A species having affinity with *D. recurvum*, Hook. f., and also *rosmarinifolium*, Forst., but differing from them in its broader heads of larger and richly coloured flowers, shorter sepals and bracts, and leaves not keeled and very peculiarly marked.

ORDER L.—BORAGINEÆ.

Genus 1. **Myosotis**, Linn.

1. *M. hamiltonii*, sp. nov.

A prostrate, perennial, spreading herb; the whole plant strigosely hairy. Stems sub-erect, 7–12 inches high, usually simple (one specimen seen forked). Leaves few, small; radical sub-orbicular, 4–6 lines diameter, slightly apiculate, tapering; petioles 6–8 lines long, much dilated at base, margins ciliate;

cauline similar, but smaller, alternate, distant, those below the middle of stems very distant; hairs on upper surface coarse, from raised black points (and so on calyx). Racemes slender, 4 inches long, 16–20-flowered. Flowers pure white, distant, alternate, very distant below; pedicels 2 lines long, curved, hairy. Calyx dark-green, shining, 5-cleft, cut one-third down, segments ovate, 3-veined, sub-acute, coarsely hairy, largely ciliate; hairs stout, red, rather distant. Corolla infundibuliform; tube cylindric, 2 lines long, veined (as also limb); scales of throat small, roundish, entire, dark-coloured; limb 4 lines diameter, lobes rounded, deeply cut, much spreading, smooth, margins slightly irregular; stamens included; anthers ovate-lanceolate, hastate; style exserted, curved, tip papillose. Nuts broadly ovoid or oval, dark-brown, shining, margined, sides nearly equal.

Hab. Stony edges of a watercourse on the Huiarau Mountain Range, running into Lake Waikare, County of Whakatane; 1887: *Mr. A. Hamilton.*

Obs. I. This slightly rambling plant covers mossy boulders in its native habitat, somewhat after the fashion of our creeping *Epilobiums*, presenting an elegant appearance from its profusion of virgin white flowers. As a species, it will rank under section 3, "Handbook N. Z. Flora," being allied to *M. australis* and to *M. forsteri*, but widely differing in several characters.

II. I have much pleasure in naming it after its kind and zealous discoverer, Mr. A. Hamilton, of Napier.

ORDER LIII.—SCROPHULARINEÆ.

Genus 7. **Veronica**, Linn.

§ 1. Capsule dorsally compressed.

1. *V. cookiana*, sp. nov.

Plant a low glabrous shrub, 1½ feet high; branches stout, short, diffuse. Leaves broadly-oblong 1½ – 2 inches long, ¾ – 1¼ inches wide, suddenly sub-acute, sub-coriaceous, sub-sessile; midrib lower half pubescent beneath; margins thickened, much and closely pubescent; petioles short, very broad, largely dilated, somewhat winged, pubescent, margins hairy. Flowers closely sub-terminal at tips of branches, presenting a thyrse-like appearance in 5 stout erect axillary racemes of many (000) flowers, very closely compacted, spreading in flower, but imbricated downwards (sub-pendulous) in fruit; peduncles 1 – 2 inches long, the lower one-third bare, densely pubescent; bracts long, narrow, subulate, pubescent. Calyx small, 1 line long, adpressed, 5-lobed (3 large and 2 narrow lobes), cut half-way to base, acute, strongly nerved, roughly pilose; margins membranous, ciliate. Corolla light-coloured with a pinkish-violet hue, small, 2 lines diameter, 4-fid, lobes spreading, nerved, the upper 3 narrow obtuse, the lower lobe narrower and acute; tube short, of equal length with calyx, much veined. Anthers 2, exserted, large, cordate-reniform, bases divergent and much produced; filaments curved, stout, spreading; style 3 lines long, flexuous. Capsule broadly ovate or sub-rhomboid, 2 lines long, sub-compressed.

Hab. Cliffs, sea-side, near Table Cape; 1887: *Mr. H. Hill.*

Obs. I. The affinities of this plant are with *V. macroura*, Hook. f., and with some states of *V. salicifolia*, Forst.; but I think it to be abundantly distinct from both. I regret my specimens having been damaged in their long transit.

II. I have with much pleasure named this sea-side species after our illustrious countryman and navigator, Cook; and that for two reasons: (1.) No plant of our New Zealand flora at present bears his honoured name, though a genus was early dedicated to him by the botanist Gmelin (since merged in *Pimelea*); and, nearly forty years ago, our second species of *Phormium* was named after him, which has also been altered: while several New Zealand plants bear the names of subsequent navigators in these our southern seas. (2.) In my selecting this seaside shrub for this purpose, I have pleasingly fancied that it was seen in its originally cliffy abode by Cook and his party, while slowly and closely coasting along the bold shores of Table Cape, on their leaving Poverty Bay for Hawke's Bay.

2. *V. compacta*, sp. nov.

Plant small, shrubby, sub-prostrate and ascending, 4–6 inches high, much and closely branched; branches short, slender, rooting, very leafy, pubescent, with a line of large white hairs decurrent on each side from petiole (resembling *Stellaria media*). Leaves small, numerous and close, elliptic and obovate, 1–2–3 lines long, obtuse, deeply cut-crenulate, 1–2 (or, rarely, 3) incisions on each side, thick, green, glandular-hairy and ciliate; margins thickened; midrib sunk and coloured on upper surface; petioles short, stout, dilated at base, semi-amplexicaul. Flowers sub-terminal, on rather long slender axillary sub-corymbose panicles, erect, 2–2½ inches long, 6–8-flowered; flowers distant, free; pedicels long, spreading, slender, ½ inch long; bracts ovate; peduncles, pedicels, bracts, and calyces glandular-hairy. Calycine lobes 4, cut to base, sub-ovate, obtuse, 3–4-nerved, half the length of capsule. Capsule large (for plant), sub-orbicular, 2 lines diameter, turgid, glabrous, not compressed. Seeds small, numerous, broadly-elliptic or sub-orbicular, smooth, flattish and sub-concave on one side, and slightly gibbous on the other.

Hab. On the lava slopes of Mount Ngaruahoe, Tongariro Range, "altitude 5,000 feet," County of East Taupo; 1887: *Mr. H. Hill.*

Obs. A species near to *V. nivalis*, Hook. f., but a smaller and slenderer and more branched plant, differing in its smaller and glandular-hairy leaves of another form, which also dry green; in its longer and more lax peduncles and pedicels, and in its capsules not being compressed and much larger than their calyces. Unfortunately, I have not seen any flowers. The plant, in its upright and close dwarf growth and habit, strongly reminds one of the dwarf box edging used for garden borders.

§ II. Capsule laterally compressed, didymous.

3. *V. vulcanica*, sp. nov.

Plant herbaceous, perennial; roots long, fibrous; stem prostrate, sub-ascending, 8–9 inches long; the whole plant (except corolla) densely hairy; hairs white, curly, sub-strigose; stems woody at bases, slender, flexuous, rooting from nodes, much branched; branchlets short. Leaves numerous, opposite, round and rotund-obovate, thick, 2 lines diameter, coarsely crenate-lobed (4–5 divisions); petioles length of leaves, broad, channelled, tripli-nerved. Flowers in small corymbs at tips of branchlets; pedicels 1 line long with a foliaceous bract at base. Calyx 4-lobed, cut to base; lobes obovate, adpressed, 2 lines long, longer than capsule. Corolla large, 8 lines diameter, 4-lobed, cut half-way down, the three upper lobes broadly rounded, the lower narrower and much smaller, veined; veins branching at tips; tube 0. Anthers 2, included, cordate; filaments short; style long, exserted; stigma capitate, rugulose. Capsule broadly obcordate, emarginate, didymous, 1½ lines diameter, a little turgid, shorter than calyx. Seeds (immature) small, broadly oval, pale; apparently few.

Hab. On the lower slopes of Mount Ngaruahoe, Tongariro Range, "altitude 4,700 feet," County of E. Taupo; 1887: *Mr. H. Hill.*

Obs. A very peculiar and distinct species.

4. *V. longiracemosa*, sp. nov.

Plant herbaceous, annual; roots short, fibrous; stem decumbent and sub-erect, 14–20 inches long, simple, rather weak; whole plant roughish sub-strigosely hairy. Leaves reddish-brown (? in age), few and distant on stem at base, broadly cordate), 8 lines long, the same breadth at base, 5-nerved, veinlets reticulate; margins irregularly incised, coarsely crenulate; tips broadly rounded, obtuse; petiole very short; the lower stem leaves smaller and narrower, sub ½ inch, soon decreasing in size upwards. Main stem yellowish, racemed, 16 inches long, simple, with 2 pairs of floral branches below, opposite and axillary (from a leaf), 8–9 inches long, flowers numerous, regular, free, sub ¼ inch apart; pedicel 1 line long, stout; bract at base lanceolate, obtuse, much ciliate, rather longer than calyx; petiole short. Calycine segments 4, split to base, linear-lanceolate, 8-nerved, ciliate, longer than capsule; tips obtuse. Corolla (?) very small, lobes rounded, pale, membranaceous, much veined, minutely punctulate with dark coloured dots; anthers rather large, reniform-cordate, blue; filaments yellow-brown; style erect, stoutish, ¼ line long; stigma capitate, penicillate. Capsule yellowish, broadly obcordate-reniform, sub-didymous, deeply emarginate, 2 lines broad, slightly compressed, glabrous, veined, finely reticulated with numerous minute longitudinal cells; opening loculicidally along the margin; valves gaping; margins ciliate; style persistent. Seeds, 7–8 in each cell, oval, slightly narrower at base, ½ line long, smooth, pale-brown, a little convex on one side and flat on the other; semi-transparent, the nucleus being clearly seen *in situ*.

Hab. Among herbage, grassy spots, margins of forests south of Danneverke, County of Waipawa; February, 1887: *W.C.*

Obs. This appears to me to be an interesting species, from its simplicity and great length of floral racemes. Unfortunately I could not obtain a single good flowering specimen, the plants having long been past flowering (indeed, were withering), but after long search I found a single minute unopened flower at tip of a raceme, whence my description of the corolla, which is necessarily imperfect. As a species it is naturally allied to our New Zealand species, *V. elongata*, Benth.; also, to some similar herbaceous Australian ones, as *V. calycina* and *V. plebeia*, of Brown; but is widely distinct from them all.

ORDER LXIII.—POLYGONEÆ.

Genus 2. **Muhlenbeckia**, Meisn.

1. *M. microphylla*, sp. nov.

Plant shrubby, depressed, 3–4 feet high, forming dense, thickly branched, matted, round-topped, impenetrable elastic bushes; main stems, ¼ – ¾ inch diameter, much intermixed and crooked, 2–4 feet or more long, very tough and hard, sub-rigid, black; branchlets numerous, long, slender, flexuous, implexed and twining; bark light-red, glossy. Leaves very few, scattered, of various shapes and sizes, mostly sub-orbicular, oblate, and broadly elliptic, ½–1 line (rarely 2 lines) long, usually about 1 line, thickish, dull green with purple margins; tips emarginate, obtuse; petioles slender, of various lengths, generally the length of the leaf, sometimes longer, channelled, slightly puberulous; stipules minute, very membranous, sub-quadrate, wavy, brown;

ochrea rather large, bladdery, red-brown, margins irregular, denticulate. Flowers axillary, 3–5–7 together in short sub-corymbose racemes; pedicels very short, about $\frac{1}{16}$th inch long, subsessile. Perianth membranous; segments cut nearly to base, large, very obtuse, crumpled, wavy, spreading, finely and closely reticulated; margins sub-crenulately-erose, white with a tinge of pink, sometimes green with white margins; adhering closely to ovary when in fruit and not succulent. Stigma large, spreading, red, sub-turbinate, very roughly papillose or irregularly and largely sub-muricate. Nuts small, $\frac{1}{16}$th inch long, blackish-brown, sub-rhomboidal or broadly lanceolate, sub-acute, triquetrous, one-third exserted, finely tuberculate or rugulose, not glossy.

Hab. Dry stony places; on ridges and mounds on hills, various places in Hawke's Bay; 1850–1886: *W.C.*

Obs. This plant I have long known, but had always until lately considered it to be identical with *M. axillaris*, Hook. fil., without, however, having closely examined it. I now find it to differ largely from that species in several important characters; also from the *M. axillaris* of Australia and Tasmania, which is said to be the same as the New Zealand species. This plant is a considerably larger and stouter one, of a different habit, with much smaller leaves and more numerous flowers, that differ in many respects as to infloresecence, texture, form and colour of perianth, size and shape of stigma, form and appearance of nut, etc. Notwithstanding, it is closely allied to *M. axillaris* in natural sequence.

ORDER LXVII.—THYMELEÆ.

Genus 1. **Pimelea**, Banks and Solander.

1. *P. stylosa*, sp. nov.

A (?) small shrub of compact erect growth; branchlets rather stout, erect, sub-fastigiate; bark reddish-grey, rough with numerous minute black muricated specks, and densely clothed with coarse short greyish hairs. Leaves yellowish-green, glabrous, close, erect, sub-imbricate, broadly lanceolate-ovate, obtuse, 4 lines long, coriaceous, much wrinkled below, very broadly keeled, petiolate; petiole thick, 1 line long. Floral leaves oblong, about same length as cauline but a little broader and more obtuse, sessile, margined, dark-green, veins closely and largely anastomosing, visible when held between eye and light. Flowers pinkish, terminal at tips of branches, 10–12 together, forming corymbose-like heads; perianth 7 lines long, thickly and coarsely hairy on the outside; limb 4 lines diameter, lobes oval, obtuse, strongly 1-nerved with veins much branched and anastomosing; tube red, rather slender, veined. Filaments exserted, long, stout, spreading; style very long.

Hab. High lands near Mount Ruapehu (Tongariro Mountain Range), County of East Taupo; where specimens were gathered and brought away by a visitor, and given to me in 1879.

Obs. A species near *P. buxifolia*, Hook. f., but the leaves are without lateral nerves, ("so conspicuous and evident in that species and forming a good character," Hook., "Handbook N. Z. Flora;") the floral leaves are smaller, the flowers very much larger, coloured, with coarser hairs, the filaments very stout and long, and the bark not "black."

Class II.—MONOCOTYLEDONS.

ORDER I.—ORCHIDEÆ.

Genus 15. **Thelymitra**, Forst.

1. *T. cornuta*, sp. nov.

Tuber 8 inches long, sub ½ inch thick, cylindrical. Stem erect, 17 inches high, rather slender, with 8 membranaceous acuminate acute adpressed bracts. Leaf single near base, lanceolate, 8 inches long, ½ inch wide, stout, thickish, semi-grooved, tip sub-acute. Flowers 6, small, rather distant on a 8-inch raceme; pedicels slender, 4–5 lines long; floral bracts shorter than ovary, 6–7 lines long, ovate-acuminate, acute, much veined. Perianth, petals clear pink, sub-rhomboidal, 4 lines long, obtuse with a slight mucro, obsoletely 5-nerved; sepals a little larger than petals, oblong-ovate, concave, dull pink with a green centre; column 2–2½ lines long, rather slender, pink, hooded; the hood smooth on the back, the base dark-red; tip bright yellow, emarginate, margins entire or very slightly erose, involute; the lower lateral margins between apex and staminodia produced into 2 little curved pointed horns, one on each side; the two lateral lobes (staminodia) sub-linear-spathulate, erect, bearing a globose bushy tuft of pinkish-white hairs, which rise above the column; hairs wavy, rugulose, obtuse, slightly knobbed at tips, hyaline with minute circular dots scattered within (not transversely barred, or septate, as in *T. nuda*); anther wholly concealed, erect, orbicular, very apiculate, tip obtuse; rostellum bifid, lobes rounded, margins thickened laciniate and jagged. Ovary long, ¾–1 inch, narrow obovoid, striate, tapering, trilateral; angles obtuse, thickish, and largely rounded.

Hab. Country near Pouto Point, North Kaipara, West Coast, north of Auckland; 1885: *Mr. C. P. Winkelmann.*

Obs. I. This species differs in several respects, particularly in its column and appendages, from all our known indigenous species; and also from the Australian and Tasmanian ones. It will naturally range under Bentham's section *Cucullaria*, its affinities being with *T. nuda* and its allies. Its flowers are very small for the size of the plant, and its ovary long.

II. In the summer of 1885 I received several specimens of *Thelymitra* from Mr. Winkelmann, but from their being long in transit, partly smashed up in passing through several of our post-offices, and from their succulent nature and close-packing half-rotten, I could make nothing of their flowers; the tubers, however, of some of them were uninjured, and I planted them; one, in particular, being long and slender, I potted. This summer (December, 1886) it produced the specimen here described. I have closely examined three of its flowers in a living state for their internal parts, and find them to correspond closely.

2. *T. concinna*, sp. nov.

Plant small, stem 4½ inches high, slender. Leaf single, narrow, 3 inches long, thin, rather membranaceous. Flowers 2, small, sub ½ inch diameter; sepals ovate, acuminate, nerved, brown; petals blue with a tinge of purple, broadly ovate, apiculate, broader than lip; column slightly hooded; margins plain, largely winged below; staminodia arising from a strong nerve, long, curved, erect, finely filiform, with only a few long and free hairs at tip, springing from 2-3 branches; hairs reddish, clavate.

Hab. Open country near the east bank of the River Mohaka, north of Napier; 1884: *Mr. A. Hamilton.*

Obs. I regret that I have only had a single specimen of this interesting little plant, which I believe to be a very distinct species. Mr. Hamilton was also struck with its peculiar and neat appearance when he gathered it, and though he sought other specimens he was unsuccessful; sheep being pastured there in that locality, soon destroy all small tender indigenous vegetation. Hitherto I have deferred publishing it, although I had examined and noted its characters (as above) while fresh, wishing first to obtain more specimens. Its small and graceful appearance, thin leaf, blue petals, narrow lip, and few reddish hairs springing in distinct bundles or branches from its staminodia, are peculiar characters. It is to be hoped that its discoverer may meet with more of the same plant when again in those parts.

3. *T. nervosa*, sp. nov.

Rather slender, straight, erect, 9–10 inches high; a white glossy sheath at base, 1 inch long, transparent, veined, truncate, margin entire with a long narrow linear mucro; 2 distant sheathing cauline bracts each 1½ inches long, acute, adpressed. Leaf single, 6 inches long, 3 lines wide, linear-acuminate, submembranaceous. Scape very slender almost wiry at top, bearing 3 distant flowers; floral bracts coloured, very broad, ½ inch long, acuminate with a long mucro, veined, minutely papillose on tips at outside, the upper flower having 2 bracts opposite, the inner one much smaller; pedicels slender, ⅓ inch long. Perianth purple, 1 inch diameter, spreading, all segments much veined, veins branching; dorsal sepal oblong apiculate; lateral sepals ovate-acuminate apiculate; lateral petals sub-obovate apiculate; labellum broadly oblong-lanceolate, obtuse; column black-purple above, largely bifid, each lobe 1-notched, incurved; the two appendages each on a long slender arm arising from below as high as the column; largely plumose at top in a globular ball; hairs very flexuous, sub-moniliform, twisted, their tips obtuse and rounded; anther broadly ovate, obtuse, apex below top of column. Ovary lanceolate, ½ inch long, coarsely ribbed.

Hab. High lands base of Mount Ruapehu (Tongariro Range), County of East Taupo; whence specimens were brought by a visitor in 1879, and given to me with some other plants (*sps. nov. supra*).

Obs. This is another small neat-looking species, with large dark-coloured flowers, their segments much veined (as also are their coloured bracts), the lower lobe or labellum being larger than the others. The number of the flowers on a plant vary, usually 3, but in one of my specimens 2, and in another only 1; each of these two plants being also smaller. A striking character is the low branching of its slender staminodiæ or lateral lobes of its column which are also elongated, and their peculiar wavy moniliform hairs. There may be more basal sheaths belonging to the plant, as my specimens do not include their roots or tubers.

A Note on Thelymitra.

I would here mention two deformed or abnormal specimens of this genus which have come under my notice; both of them obtained in 1884, in the hilly forests near Norsewood, and apparently varieties of *T. purpureo-fusca*, Col.*

1. A small 1-flowered specimen; the perianth consisting of only four equal segments.

2. Another small specimen; the column of its perianth containing 3 staminodiæ, one of them being in front, arising from the junction of the two wings at the lower front base, and with the other two lateral ones curiously enclosing the top of the column.

Genus 17. **Prasophyllum**, Brown.

1. *P. variegatum*, sp. nov.

Stem slender, erect, 5 inches high, green above, red below, minutely speckled with white papillose spots, sulcated on one side, with a loose sheath below near base. Leaf, ¼ inch under spike, very short, about ½ inch long, striate, adpressed, sub-acute, tip thickened. Spike short, ½ – ¾ inch long, few (3, 5, 8,) flowered; flowers rather distant, drooping; bracts very small, adpressed, broad, truncate and retuse. Perianth greenish tinged with red, small, 1–1½ lines long; dorsal sepal broadly ovate, 8-veined, tip acute; lateral sepals ovate-acuminate, 3-nerved, tips sub-mucronate, dilated; lateral petals very small, narrow, lanceolate-acuminate, 1-nerved, tips acute, labellum short, sub-cordate-ovate, sub-acute, reticulately veined, 1-nerved, the nerve central and very narrow, margins red, sub-tuberculate-fimbriate; anther large; column very short. Ovary sub-erect, 8 lines long.

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* "Trans. N.Z. Inst.," vol. xvii., p. 349.

Hab. Glenross, County of Hawke's Bay; 1887: *Mr. D. P. Balfour.*

Obs. I have received several specimens of this plant, but all, save one, had just passed flowering; they were very much alike, merely differing (as above noted) in the number of their flowers.

Order VII.—LILIACEÆ.

Genus 5. **Astelia**, Banks and Solander.

1. *A. planifolia*, sp. nov.

Leaves sub-coriaceous, linear, very acuminate, 24–26 inches long, ½ inch wide at middle and 1 inch at dilated base, flat, upper surface glabrous, dull light-green; lower surface hairy; hairs short, closely adpressed in uniform dot-like patches; margins flat, entire, and slightly and sparsely sub-ciliate; 8-nerved, the two central nerves narrow, very prominent on upper surface; the base dilated with a few short hairs, margins very thin. Scape (*fem.*) 3–4 inches long (including short raceme), stout, erect, cylindrical below but obtusely sub-triquetrous above, clothed with short adpressed white hairs, (as also pedicels, and outsides of floral bracteoles,) with 4 cauline foliaceous bracts, the lowermost 8 inches long, very acuminate and nearly as wide as the leaves, sub-amplexicaul, slightly silky and shining; raceme sub-corymbose, short, about ½ inch long, composed of 10–20 flowers; pedicels very stout, 8 lines long, close together and subverticillate, each with a long subulate bracteole at base. Flowers: perianth whitish, glabrous, very membranous, spreading, sub-rotate, adhering to ovary below middle; segments 6 (sometimes 4, 8,) linear-ovate, split nearly to base, tips incurved; the three outer broader than the three inner ones, reddish, scarious, obsoletely 1-nerved, reflexed in age; style 0; stigma, short, sessile, obtuse, obscurely 3-lobed, papillose; anthers (abortive) long, narrow, opposite segments. Ovary sub-rhomboidal or broadly ovoid, green, glabrous; beak short, slightly grooved; seeds immature.

Hab. Forests, Pohue, hilly country west of Napier, Hawke's Bay, growing in rather small tufts on rotten logs; 1884: *Mr. A. Hamilton.*

Obs. I have received only one flowering specimen of this plant; and this I have had some time by me. At first sight I saw it was widely different from all the other (now) many species of this peculiar and interesting genus known to me, and I delayed making it known, hoping to obtain further specimens of it bearing ripe fruit (as Mr. Hamilton had planted it in his garden); also a specimen of the male flower from its native woods. A species having affinity with *A. graminifolia*, mihi.*

ORDER XI.—CYPERACEÆ.

Genus 13. **Uncinia**, Persoon.

1. *U. capillaris*, sp. nov.

Plant small, densely cæspitose in large patches. Culms few, 8–10 (rarely 12) inches long, exceedingly slender, almost capillary, sub-cylindrical, channelled smooth, erect, tips drooping; leafy, 4–5 sheathing leaves on stem. Leaves numerous, a little shorter than culms (sometimes, though rarely, longer), 1/50th-inch wide, green, striate, channelled, keeled, sub-erect, drooping at tips, margins slightly scaberulous; tips truncate and thickly scaberulous; below 2–3 sheathing basal bracts with long awn-like tips; young leaves capillary. Spikelets distichous, lax, 1½–2½ inches long, with 4–7 distant spreading *fem.* flowers; the upper portion, ½ inch, *male* flowers which are closer. Bract 0. Glumes fugacious, ovate, sub-acute, ⅔rds length of utricle, smooth, nerve stout and more so at tip, margins around apex produced, hyaline. Utricle 3 lines long, narrow-lanceolate, triangular, smooth, striate, greenish (light-brown in age); bristle 2 lines long, slender, flexuous, spreading, white; hook large. Style long and very rough; stigmas 2, long, curled.

Hab. In thick dry woods, south of Danneverke, County of Waipawa; 1887: *W.C.*

Obs. A species peculiar for its mode of growth, forming large and thick spreading patches; also for its excessively narrow leaves and culms, lax, distant and few-flowered spikelet, and bifid stigma.

2. *U. disticha*, sp. nov.†

Plant forming straggling tufts, much drooping. Culms 22 inches high, slender, sub-angular, channelled on upper surface, scabrid, leafy with 4–6 sheathing leaves on culm. Leaves (and culms) green, about same length as culms, linear, 1/20th inch wide, flat, striate, veins red, keeled, scaberulous, very acuminate, tips sub-acute, much drooping. Spikelet small, weak, distichous, 1½–2 inches long; *fem.* flowers 6–7, lax; the upper ½ inch

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* "Trans. N.Z. Inst.," vol. xix., p. 267.

† I note that Müeller has a species "*debilis.*"—W.C.

male, and more compact. Glume persistent, ovate, sub-acute, nearly as long as utricle, whitish, smooth, 1-nerved; nerve stout, greenish. Utricle lanceolate, stoutish, 2½ lines long, sub-half-terete, scabrid towards top, whitish; bristle erect, 2 lines long, white; hook 1 line long, brownish, thick and dark at bend, tip excurved, sub-acute. Style long, stigmas 3, very long, flexuous, and (with style) roughish.

Hab. In dry woods with preceding species, *U. capillaris*, Col.; 1887: *W.C.*

3. *U. variegata*, sp. nov.

Plant forming fine medium tufts. Culms 18 inches long, erect, rather stout, sub-rigid, smooth, pale green, finely striate with white lines, triquetrous, angles very obtuse, with one side broader and flat and two sides deeply channelled. Leaves longer than culms, 2 feet long, 2 lines broad, green, many-nerved, striate, sub-flaccid, keeled, keel white, minutely scaberulous on keel and margins. Spikelet cylindrical, stout, thickly set with flowers, sub-sexfariously disposed and closely imbricated by its long glumes concealing the utricles, 4 inches long, 4–5 lines broad, brownish variegated with green lines from glumes and bristles; the upper portion *male*, ½–¾ inch long, narrow, cylindrical, very compact. Bracts at base, 2, nearly close together and opposite, scabrid; one very long, foliaceous, flaccid and spreading, 9 inches long; and one much smaller, the length of spikelet, setaceous, erect, adpressed to spikelet; tips obtuse, sub-clavate. Glumes of female large, 4½ lines long, $\frac{1}{30}$th inch wide, lanceolate, sub-acute, nearly covering both utricle and bristle, pale light-brown; 3-nerved (obsoletely 5-nerved at base), central nerve wide but not prominent, green, reticulated; cells long, narrow. Glumes of male very similar, but a little shorter. Utricle broadly ovate-acuminate (or sub-rhomboidal) tapering a little at base, 2 lines long, dark-reddish-brown, smooth, glossy, turgid; bristle slender, 2–2¼ lines long, erect, green; hook brown. Seed broadly-oblong, smooth, shining, sub-triangular, flattish and slightly concave on one side, edges obtuse, even, not raised or margined. Style very short, sub $\frac{1}{60}$th inch, rough; stigmas 3, very long (2 lines), spreading, flexuous, rough and shaggy with broad flat patent hairs. Anthers linear, sub-acute, scarcely appearing from within glumes; filaments short.

Hab. Sides of streams in forests near Danneverke, County of Waipawa; 1887: *W.C.*

Obs. A species having pretty close affinity with *U. australis*, Persoon, and *U. ferruginea*, Boott; and also with *U. alopecuroides*,* Col.; differing, however, from them all in several important characters (*vide descript.*).

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* "Trans. N.Z. Inst.," vol. xv., p. 335.

ART. XXVIII.—*On newly-discovered and imperfectly-known Ferns of New Zealand, with Critical Observations.*

By W. COLENSO, F.R.S., F.L.S., etc.

[*Read before the Hawke's Bay Philosophical Institute, 11th July,* 1887.]

Class III.—CRYPTOGAMIA.

ORDER I.—FILICES.

Genus 1.* **Gleichenia,** Smith.

§ EUGLEICHENIA.

1. *G. patens*, sp. nov.

Plant erect, about 3–4 feet high (from specimens received). Rhizome creeping (apparently epigæous), very long (in specimens 2 feet or more), rather slender, 1½ lines diameter and of uniform thickness, pretty straight, rarely branched, light reddish-brown (as also stipe), roughish (sub-muricate); scales few, scattered, broadly ovate-cordate, reticulate, coarsely fimbriate; rootlets numerous, wiry, branched, 1–3 inches long, descending from under-surface only at irregular distances, ½–1 inch apart, single and in bunches of 2–3, resembling nodal rootlets. Stipes about 2 feet apart on rhizome, 2–3 feet long, dry, slender, uniform, cylindrical, about 1 line diameter, hollow with a central pith, straight and sub-flexuous, smooth, shining, 2-branched at top, these two main branches opposite, squarrose, spreading, with a large bud in their axil (also in the axils of the secondary branches), and 4 pinnæ at their bases, 2 up and 2 down. Frond large, spreading, dichotomous, distantly branched at almost right angles; branches and branchlets very slender, sub-bipinnate, light-red-brown; rhachis and sub-rhachises thickly covered with dark-brown adpressed scales (similar to those on rhizome), their fimbriæ or stout hairs patent, rigid, dark, wavy, acute; branchlets sub-linear-ovate or linear-oblong, 5–6 (sometimes 8–9) inches long, 2–3 inches wide, ultimate branchlets forked, imparipinnate. Pinnæ petiolulate, free, linear not acuminate, 1–1½ inches long, 1–2 lines wide, bright green above, a little paler below, glabrous, patent and sub-falcate, symmetrical, very distant, 2–3 lines apart and alternate on rhachis, 3–5 lines apart opposite and sub-opposite on secondary branches, sometimes, though rarely, 2 together, and sometimes forked; midrib truncate, or with a smaller oblique lobe at apex; lobes distinct, cut to rhachis, alternate, close at bases but divergent at tips, presenting a zig-zag appearance, the lowest pair opposite larger and more distant, semi-elliptic or sub-quadrilateral, with top rounded, apiculate, flat margins not recurved when fresh, membranaceous, full of minute pellucid dots when held up between the eye and light; veins pinnate, sub-flexuous. Sori few, scattered, a single sorus on a lobe on the middle of anterior veinlet nearer margin than midrib, mostly containing 2 capsules, often only 1, more rarely 3. Capsules sessile, globular, pale, shining, superficial.

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* The numbers attached to the orders and genera in this paper are those of them in the "Handbook, Flora of New Zealand."

Hab. Near to hot springs at Wairakei, Taupo; 1887: *Mr. C. J. Norton.*

Obs. I. This species is closely allied to another of our New Zealand species, *G. punctulata*, Col.,* which, however, is a much smaller plant; also, but much less so, to two Australian species, *G. microphylla*, Br., and *G. circinata*, Sw.; (this latter species, however, is said by several botanists—Sir J. D. Hooker, Baker, and Bentham—to be one with Brown's plant). The species here described differs from them all in several particulars, some of which are grave characters; especially in its plane soft membranaceous and truncate pinnæ, which are also almost unicoloured, with apiculate lobules, in the paucity of capsules in a sorus, and in its highly peculiar fimbriate scales.

II. Swartz has given a very clear and full description of his typical *G. circinata* in his "Synopsis Filicum," from which work (as I think it is very rare here among us) I extract a brief portion, viz.:—"G. circinata: *pinnæ* sessiles lineares sub-filiformes rigidulæ: *pinnulæ*" (lobes), "sub-coadunatæ semi-rotundæ, minutæ, convexæ, subtus concavæ, costaque pubescentes: *sori* ex capsulis sæpissime quatuor in foveola margini sub-immersis;" and, again:—"*Obs.* Distinguitur a *G. polypodioide* pinnis longioribus pubescentia notabili et soris plerumque ex quatuor capsulis compositis." (*loc. cit.*, p. 394.)

III. To any observant person, whether botanist or not, acquainted with the more common forms of our New Zealand *Gleicheniæ* of this section—as *G. hecistophylla*, *G. dicarpa*, *G. alpina*, etc.—the striking difference between them and this species is apparent at first sight on seeing this fern, indeed there is but little ground of close comparison between it and them. I have received many specimens of this fern from its discoverer, in different stages of growth, to examine, and find them uniform in their characters; and having given it a long, repeated, and exhaustive examination, (aided largely by correct drawings with dissections of the allied species, *supra*,) I feel convinced that it is a truly distinct species.

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* "Trans. N.Z. Institute," vol. xvii., p. 245. See also my general observations there.

IV. Mr. Norton informs me, by letter, that he has seen specimens of this fern in its native habitat "8 – 10 feet long;" and I also find from him that it is impatient of cold, "dying down in the winter;" owing, no doubt, to its more delicate membranaceous fronds, a character which is also rare in this genus.

Genus 4. **Dicksonia**, L'Héretier.

§ Eudicksonia.

1. *D. microcarpa*, sp. nov.

Plant arborescent, caudex erect, 6–7 feet high, stout, 1 foot diameter, pretty nearly equal throughout, the outside composed of a closely compacted mass of fine brown rootlets, their surface even not shaggy nor ragged; at the upper portion under the crown of living fronds are the remains of a few old broken stipites. Fronds 80 or more, patent, a little drooping with their tips generally upcurved, sub-tripinnate, narrow lanceolate, 4½ feet long including short stipes, 1 foot broad at the widest part, sub-membranaceous-coriaceous, glabrous and somewhat glossy on upper surface, grass-green above, paler below; rhachis and sub-rhachises very hairy on both surfaces; hairs short, weak, flexuous, jointed, sub-glandular, brownish-grey. Stipes short, 2–8 inches long, succulent, very hairy; hairs dense, 1½ inches long, patent, fine, jointed, glossy, red. Pinnæ 45 – 48-jugate, alternate, sub-ovate-lanceolate, 5–6 inches long, 1¼–1½ inches wide, very acuminate, tips exceedingly long and slender, recurved, falcate, the middle ones close about 1 inch apart on rhachis, overlapping, the apical free, narrow, and simple, the ultimate pinna very long, narrow, and serrate, the basal pinnæ distant, small, decreasing gradually in size to base. Pinnules close, not crowded, symmetrical, attenuate, the lower pair overlapping rhachis above, sub-linear-lanceolate, acuminate, acute, ¾ inch long, broadest at base, and there ¼ inch wide; the midrib hairy half-way from base. Segments 8-jugate, small, sub-ovate-deltoid, serrate, acute, 1–2 lower pairs pinnate, petiolulate, midrib flexuous, margins recurved when dry. Veins few, prominent below, pinnate, generally 8 pairs (sometimes 4 on one side), simple, rarely forked, red, translucent. Sori small, globose, biseriate, usually 4 on the larger segments at tips of veins, sometimes 8, 2, or only 1, extending to the utmost tips of pinnules and pinnæ; capsules shortly pedicelled, the joints of the ring very prominent, close, and dark-coloured; sporules bright-yellow, sub-orbicular-deltoid, obtuse. Involucre globular, 2-valved; the outer valve formed from apex of serrature of segment, the margin scarious, thin; the inner valve scarious; margins entire.

Hab. Forests south of Danneverke, County of Waipawa 1887: *W.C.*

Obs. This species has a pleasing appearance living, from the graceful airiness and softness and light-green colour of its rather small fronds, reminding the beholder, at first sight, of another arborescent fern of those forests, *Hemitelia smithii*, Hook. fil. (Like some other of our ferns it, unfortunately, loses its pleasing green colour in drying.) It approaches *D. fibrosa*, Col., more nearly than it does *D. squarrosa*, Swartz; but it is still more nearly allied to *D. sparmanniana*, Col.,* and to *D. gracilis*, Col.,† differing however from both in its smaller and much narrower fronds and segments, and also from *D. sparmanniana* in being arborescent, and in its very small sori and involucres; and from *D. gracilis* in the great difference in its caudex, and in its veins, sori, and involucres being scarcely half the number of those of that species on a segment, as well as in several other particulars. Hitherto I have not met with many plants of this species in the forests.

Genus 11. **Adiantum**, Linn.

1. *A. polymorphum*, sp. nov.

Plant small, gregarious, cæspitose in small tufts, each one usually consisting of 8 living fronds that are sub-erect but often deflexed from base of frond. Root-stock small, about ½ inch, composed of several broken purple-brown stipites; roots fibrous, hairy. Fronds very membranaceous almost translucent, glabrous, grass-green, sub-linear-ovate, attenuate, simple pinnate (in their normal state), 2–8 inches long, broadest at base and there ¾–1 inch wide; pinnæ 8–12-jugate, alternate, free, close and distant, somewhat semi-orbicular, the anterior margin much arcuate, the lower margin arched nearly to correspond, apex rounded, base sub-truncate or excised in a curve and so imbricating rhachis at the upper angle; the superior and apical margins of pinnæ largely crenate-lobed; lobes rounded, every alternate sinus deeper and bearing a sorus distant from outer margin of pinna, every pinna usually soriferous, and decreasing gradually in size to apex, all petiolate, the dark petiole extending a short distance into the pinna at lower basal margin, the upper pinnæ are sometimes quadrilateral; the lowest pair of pinnæ much the largest, each pinna ⅓ inch long by ¼ inch broad; the terminal lobe small, rhomboid, obtuse, sometimes bearing an involucre at the extreme tip. Veins branched, dichotomous, free, rather distant, flabellate in smaller pinnæ and at base of larger pinna, the principal vein parallel with and close to the lower margin, branches unilateral; apices of barren veins curving over involucre on both sides between it and the margin of pinna. Involucres large, distant, orbicular or sub-reniform-cordate, flat, closely appressed, white with broad wrinkled margins, 5–6 on a large pinna (sometimes, but rarely, 8–9 on the lowest), extending quite round the apex to its lowest corner, 2–3 on the smaller pinnæ; the sinus at first narrow-linear, then circular, in the centre of involucre. Stipes generally longer than frond, 3–5 inches, very slender, almost capillary, wiry, sub-angular, dry, brittle, glossy, dark-purple (as also rhachis and petioles), with a few short linear obtuse brown scales near base.

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* "Trans. N.Z. Inst.," vol. xii., p. 868.

† "Trans. N.Z. Inst.," vol. xv. p. 806.

Sometimes a frond is met with bearing a small pinnate branchlet at its base, having 2–5 pairs of pinnæ, same as those on main rhachis but much smaller; and occasionally a frond is found with two such divergent branchlets, but smaller still at its base. I have also a specimen with two long forked branchlets forming a fork at tip of rhachis, as well as two others at base of the frond, and thus having four branchlets besides its ordinary main rhachis. Sometimes the lowest pair of pinnæ are large and irregular in shape, sub 3-lobed, and sometimes largely reniform.

Hab. On the ground at a steep declivity, forming a small bed or patch, and very closely growing together, in a thick wood south of Danneverke, County of Waipawa; May, 1887: *W.C.* (Not noticed anywhere else.)

Obs. I. It is difficult to fix the near affinities of this interesting little species among our known New Zealand *Adiantæ;* it has certainly a family resemblance, but that is common to the whole of them. Its nearest ally is *A. diaphanum*, Bl., a Java and Manilla fern (judging from description and drawing of that fern as given by Sir W. J. Hooker, "Sp. Filicum," vol. ii., p. 10, tab. 80), but that species differs from this one in several particulars; that one being of larger size, with differently shaped, hairy, darker colour, and obscure pinnæ, small crowded involucres, etc. Sir W. J. Hooker has also stated (*l.c.*) that the specimen he had there figured is an authentic type specimen of that species given to him by Dr. Blume, its discoverer.

That fern (*A. diaphanum*) is also said by Bentham* to be found in Queensland, New South Wales, and New Zealand; but I have never met with it growing, though lately I received some specimens of the plant from the interior, which agree well with Sir W. J. Hooker's description and figure. Bentham's description of it, however, differs widely from Hooker's description and figures. And I also notice, that Bentham there includes one of our well-known and common New Zealand *Adiantæ*—*A. affine*, Hook., not Willd.†—with Blume's *A. diaphanum*, as being identical with it! Baker, also,‡ says the same—viz., that the New

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* "Flora. Austral.," vol. vii., p. 725.

† "Sp. Fil.," vol. ii., p. 32.

‡ "Syn. Fil., p. 117.

Zealand fern, *A. affine* of Hook. = *A. setulosum*, J. Sm., is identical with *A. diaphanum* of Blume.

Be that as it may, those two ferns (*A. diaphanum* and *A. setulosum*) are very distinct from this little *Adiantum* here described.

2. *A. tuberosum*, sp. nov.

Plant very small, weak, sub-erect, gregarious, cæspitose in small tufts, 1½ – 2 (rarely 3) inches high; rhizome creeping, pubescent, tuberous (also the numerous long and slender branched rootlets) with many little brown oblong and obovoid tubers singly scattered, each producing a single frond. Stipe 1 – 2 inches, capillary, somewhat flexuous, sub-angular, smooth, glossy, red-brown (as also rhachis and petioles), with a few small narrow acute scales at base. Frond simple, narrow oblong-ovate, 1 – 1½ (rarely 2) inches long, 5 – 8 lines broad at base, pinnate, mostly 5- (sometimes 7-) jugate; pinnæ alternate, distant, sub-reniform-quadrilateral, petiolate, spreading, dull green, glabrous, superior margin slightly arched, the inferior less so, nearly straight; apex broadly rounded; base slightly excised; sometimes the bases of a pair of pinnæ are imbricate; the lowest pair generally larger and sub-deflexed; the upper pinnæ sub-cuneate; the terminal one large 4-sided, obtuse; minutely and closely dotted (*sub lente*) with very short reddish-brown pubescence (or sub-papillose scurf) on the middle and basal portions of pinnæ under surface; margins toothed-serrate, irregularly sub-lobed. Veins distant, dichotomous, dark, coarse, rather prominent, reaching to margins and forming acute teeth. Sori few, small, distant, irregular, mostly 2 – 4, sometimes 5, on a pinna, very rarely 6 – 7 on the lowest and largest one, extending round apex, distant from margin and the margin deeply crenate; the terminal pinna bearing 4 – 6 sori. Involucre reniform and sub-reniform-orbicular, at first white and closely appressed, brown contracted and sub-revolute in age; sinus very large and broad.

Hab. Woods near Ormondville, County of Waipawa: *Mr. A. Hamilton.*

Obs. This species is pretty closely allied to the preceding one, but differs in several important characters. At first sight I supposed it might be a still smaller state of that plant, but a close examination with plenty of good living specimens in all stages has convinced me of it being distinct. It is a much smaller plant, of a simple unvarying form, with a different habit of growth; the several distinct tufts of fronds closely arising from the hypogæous rhizome resemble a broad fringe; its tuberous rhizome and rootlets is a peculiar and rather strange character; the pinnæ are thicker, duller and of a different shape with sharply toothed margins; veins coarse, dark, and prominent; the ultimate pinna large and bearing sori all round on its four sides; sori few and distant; involucre smaller and brown.

8. *A. affine*, Willd., var. *heterophyllum*, Col.

Plant pale green, sub-erect, 10–14 inches high, forming large tufts. Stipes 6–8 inches long, slender, dry, smooth, glossy, and dark-red-brown (as also are the rhachis and stipes of pinnæ), flexuous, sub-angular above semi-terete below, with a few short hairs at base. Frond bipinnate, sub-ovate-acuminate, 5–7 inches long, few branched below; branches simply pinnate, their tips crested, spreading in 2–3 short and close branchlets, each with a large and broad 2–3-lobed laciniate and toothed ultimate pinna. Pinnæ very irregular, large and small mixed, of various sizes and shapes, narrow cultriform with obtuse tips, and sub-cuneate, 2–9 lines long, 1–2½ lines broad, the lower margin entire and curved upwards at tip, the upper laciniate and toothed, teeth white; stipitate, stipes capillary, rather long. Sori small, few (1–2–5) and rather distant on a pinna, on the upper margin only. Involucre orbicular-cordate, pale flecked with brown dashes, dark brown in age, shining, turgid; sinus narrow.

Hab. On limestone crags at Moteo, Puketapu District, near Napier; 1885: *Mr. A. Hamilton.*

Obs. This is a curious and rather neat-shaped little fern, apparently a variety only of our more common *Adiantum;* though some of its characters (apart from the crested tips of its rhachis and branches) may prove to be distinct and grave enough to make it a good species. I have seen and examined several specimens, and find them pretty uniform in character, while varying a little in size.

Genus 15. **Pteris**, Linn.

§ 2. LITOBROCHIA.

1. *P.* (*L.*) *pendula*, sp. nov.

Plant cæspitose, of 4–6 fronds; caudex very short, scarcely any, composed of old stipites; roots numerous, fibrous, long, slender, spreading. Frond pendulous, broadly deltoid, 10–12 (rarely 14) inches long, membranaceous, glabrous, shining, but filled with minute sub-rugulose dots, flaccid, flat, green; rhachis straight, pale stramineous, bipinnate (the larger specimens tripinnate below); ultimate pinna of frond very long (3–5 inches), narrow-ovate- or lanceolate-acuminate, segments opposite 7–10-jugate, very distant and decurrent (which decurrence is sometimes continued down to below the third pair of pinnæ from base), the tip very narrow acuminate-caudate; pinnæ opposite, few, 4–6 pairs, distant, spreading, ovate-acuminate, their rhachises straight; petioles slender, the three lower pairs about ½ inch long; pinnules alternate, distant, ovate-acuminate; 2–2½ inch long, 3–4 pairs on each secondary rhachis, the lowest (or lowest 2) on rather long and slender petioles, the upper pairs sessile, decurrent, the terminal one very acuminate, often caudate; segments large, open, not crowded, spreading, mostly 5 (sometimes 6–7) pairs, opposite and regular, their margins and apices coarsely and deeply incised; the lowest pair free, narrow, oblong, largely pinnatifid, base cuneate; the upper ones deltoid, broad, (their tips sometimes largely and irregularly bilobed,) their anterior margins almost straight, sometimes subfalcate, their bases largely decurrent; apices obtuse, sometimes bifid; sinuses narrow; veins few, distant, clear, the basal veins free, with 6–7 long narrow areoles on each side of midrib of pinnule (generally from costule to costule), and 4–5 areoles on each side of costule of segment, and both extending nearly to tips; the outer veins free, forked, and branched to margins; sometimes a single second-series areole is formed between the costule areoles and outer free veins in the broader segments. Stipes 7–9 inches long, rather slender, glabrous, shining, channelled above, straw-coloured and dark-brown towards base, with a few scattered scales below. Scales dark-brown, subulate, 3½ lines long, ¼ line broad at base, very acuminate, tip produced and truncate, margin flexuous, netted, cells large longitudinal subparallelogramic, walls dark and double, with oval and round dark (stomate-like) bodies scattered in them. Sori in short narrow lines (and dots) on central margins of segments both sides, not at sinus nor near tips, the upper half of segment generally barren; sometimes the sori are more continuous on the upper decurrent wings on the main rhachis. Involucre whitish, exceedingly narrow, $\frac{1}{50}$th inch wide (soon becoming reverted and hidden by the sori), delicate, pellucid, very curiously reticulated, the cells large with exceedingly fine and tortuous margins; margins of involucre entire, very slightly sinuous. Sporangia broadly obovate, sub-sessile, dark-brown, bursting in the middle, and so separating into two cups, their membrane pellucid, reticulated. Sporules triquetrous, angles obtuse, dark-brown, roughish; margins entire with a double line and transverse bands.

Hab. Ever shaded wet-dripping gravelly cliffs (among other ferns and shrubs), banks of a stream south of Danneverke Township, County of Waipawa; 1887: *W.C.*

Obs. I. This species of fern is nearest to our endemic New Zealand fern *Pteris (Litobrochia) macilenta*, A. Richard, but differs from it in several particulars—as habit, size, and outline of frond, and shape of pinnæ, pinnules, and segments; in its lobes being wholly and largely incised, the terminal ones being excessively narrow and caudate; its veins much more anastomosing and also branched; its lines of sori smaller and more scattered, and their involucres being very much narrower and of a different substance.

II. It is not, however, without some hesitation that I bring forward this handsome fern as a new species; and I only do so after long and close examination of several specimens, including whole tufts of living plants. Of all our known New Zealand ferns (as I have already said) this one is more nearly allied to *Pteris* (*Litobrochia*) *macilenta.* Fortunately I possess the full history of that fern, including the fine folio engraving of the type specimen, together with the ample original description of it given by its describer, A. Richard;* and of that engraving Sir W. J. Hooker remarks (in his more fully describing *Pteris* (*Litobrochia*) *macilenta*): "Richard's figure faithfully represents the frond."† Indeed, had I not Richard's figure and description, supported as they are by Sir W. J. Hooker, I do not think I should care to describe this fern as a new species, through my not having at hand a genuine specimen of *Pteris macilenta.* There is, however, a very great amount of difference between Richard's figure and this new plant; as is also further shown in his specific description of *Pteris macilenta*, some of which I shall quote to demonstrate how much it disagrees with that of this fern, for I suppose his botanical work containing it is but little known here among us:—"Frondibus bipinnatis . . . pinnulis *paucioribus* distantibus *oblongis* pinnatifidis; laciniis *integris* aut apice inciso-dentatis glabris, membranaceis; indusiis membranaceis margine *continuis*" (*l.c.*). And, in his further "observations" upon the newly-discovered plant, he goes on to say: "Cette espèce est bien remarquable par son port, qui la distingue au premier coup-d'-œil de toutes les autres espèces du genre, et qui la rapprocherait plutôt de certaines espèces de *Lindsæa.* Ses frondes sont longues d'environ un pied et demi, et même deux pieds, et composées *d'un très-petit nombre* de folioles écartées les unes des autres, et plus ou moins profondément pinnatifides. Les divisions de ces pinnules sont ou *entieres* ou irrégulièrement dentées *a leur sommet*, constamment très-glabres." (*l.c.*)

III. A. Cunningham, in his "Precursor of New Zealand Botany,"‡ quotes entire, with apparent approval, Richard's specific description, and that without any addition of his own, A. Cunningham having also detected this fern at the north, "in dry woods at Whangaroa," in 1827; and, subsequently, his brother, R. Cunningham, "in similar situations in that locality, in 1834."

IV. Sir W. J. Hooker also, in his more fully and specifically describing *Pteris* (*Litob.*) *macilenta*, says: " . . pinnæ and pinnules *remote alternate*, ultimate pinnules *small* (1–3 inches) *ovate*

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* "Voyage de L'Astrolabe: Botanique," p. 83.

† "Species Filicum," vol. ii., p. 220.

‡ "Companion, Botanical Magazine," vol. ii., p. 365.

or deltoid, cuneate at the base petiolate, pinnatifid, terminal ones elongate acuminate, *lobes oblong or ovate* acute, coarsely inciso-serrate *at the apex*, basal veins forming a single arc and *2 or 3* large areoles on each side of the costule of the segments, the *rest of the veins free*:" and again, he says, "the pinnules are *small*, and there are but *few* areoles, and those confined to the costa and costule (*not extending to the apex of the latter*), *the rest of the veins are free.*" (*l.c.*)

V. Sir J. D. Hooker also, says, in his greatly enlarged specific description of *Pt.* (*Litob.*) *macilenta*,* "Venis *rarius furcatis* nunc *basi* anastomosantibus. Soris *sinubis latis continuis*;" and, further on, "pinnules . . . the lobes *oblong*, sharp, sharply coarsely toothed *towards the tip*. Sori *continuous in the hollows*." And in his still later work ("Handbook N.Z. Flora," p. 364), he says, "Costa *flexuous*, pinnules *scattered* . . *ovate-oblong*, veins *forked*, *netted towards their base only*. Sori *in the notches broad*." And this statement of his, twice repeated, viz., "soris *sinubis latis continuis*;" and, "sori *in the notches broad*;" agrees not only with Richard's figure, but most particularly so with his magnified dissections of the sori and their *broad involucre covering them*. And to this may also be added Baker's remark on this fern, "Rhachis *flexuose*, veins fine, not anastomosing much except the costal arches." ("Synops. Fil.," p. 171.)

I have observed (*supra*) that this fern, *Pteris* (*Lit.*) *pendula*, is more nearly allied to *Pt.* (*Lit.*) *macilenta*, of all our New Zealand ferns. It is, however, also pretty closely allied to *Pt.* (*Lit.*) *endlicheriana*: and so serving, as it were, as an intermediary to unite in a still more natural sequence the New Zealand and South Pacific ferns of the *Litobrochia* section of the *Pteris* genus. I may further notice that this fern is also very near to the *Campteria* section of that large genus, from which it only differs in its outer veins being branched as well as forked; while its excessively narrow involucre allies it equally with the *Platyloma* section of the closely allied and scarcely distinct genus *Pellæa*: indeed, it seems in all its characters to unite all four sections, *Eupteris*, *Campteria*, and *Litobrochia*, of the genus *Pteris*, together with *Platyloma* of *Pellæa*.

Having stated this, I may also quote here a similar observation made by Sir W. J. Hooker on another of our New Zealand ferns and its compound venation, *Pt. incisa*, viz.: "We shall find that one well-known species (*Pt. incisa*) unites in itself three kinds of venation, that of true *Pteris*, of *Campteria*, and *Litobrochia*; and other species present quite intermediate characters." ("Sp. Fil.," vol. ii., p. 207.)

My mentioning *Pt. incisa* reminds me of what A. Richard had also said of that fern, in his original description of *Pt.*

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* "Flora N.Z.," vol. ii., p. 26.

macilenta (already in part quoted, *supra*), viz.: "Cette espèce s'approche un peu du *Pteris vespertilionis* de M. Labillardière,* mais néanmoins elle en est fort distincte." (*l.c.*) This observation of his is the more valuable here, inasmuch as he had just before said of *Pt. macilenta* that at first sight it more resembled a species of *Lindsæa* than one of the genus *Pteris* (*supra*). And why so? What was it in particular that called forth that double remark, as it were, at that one time respecting this fern, *Pt. macilenta?* I only know of one striking character (or, at most, two) that could have led to it—viz., the lobes being large with their margins entire, and the involucre broad and continuous. The figure of *Pt. vespertilionis*, as given in Labillardière's large work,† now before me, (which very likely Richard had also before him at the time of his writing,) bears out this supposition, as the lobes of the pinnules are all remarkably entire and free from the least amount of incision or denticulation, not having any even at their tips.

In conclusion, I may further mention that I have noted the very much larger size of *Pt. macilenta* ("5 feet high") as given by Hook. f. and Baker, when compared with that given by Richard; but I may say that I have also seen such large specimens of *Pt. macilenta* in the dry woods at the north; yet, while possessing such very much larger fronds, it still preserved its peculiarly distinctive and striking characters of small ovate and distant pinnules: which unique specific appearance had caused Sir W. J. Hooker to say respecting it: "It were a great blessing if all *Pterises* were as distinct as this. It is difficult to say which are its near affinities." (*l.c.*, p. 220.)

Genus 16. **Lomaria,** Willdenow.

1. *L. paucijuga*, sp. nov.

Plant small; caudex (specimen, a top broken off) ascending, 1 inch long, hard and woody, as thick as a common lead pencil, with several old stipites and scales on it below the living fronds. Fronds (4, all sterile,) sub-opposite, or tufted, erect, equal, uniform; lamina herbaceous, olive-green, ovate, sub-acuminate, 8 inches long, 1½ inches broad, pinnatifid; lobes, 4–5 pairs, short, opposite, oblong, 9 lines long, 5 lines broad, very obtuse, spreading, rugulose, close and slightly overlapping, glabrous (not glossy) on upper surface, largely and finely pilose on under-surface and on rhachis; hairs hyaline, jointed; margined, puckered, much veined; veins conspicuous, branched, extending to margin, clavate, red; margins white, cartilaginous and recurved, undulate and slightly crenulate-denticulate, closely ciliate; the lowest pair of lobes cut nearly to rhachis and shorter than the pair above them, and much broader in the lower basal portion, which is cordate sub-auricled and divergent; the upper lobes cut about half-way to rhachis; the terminal lobe large, broad, sub-ovate-acuminate, the base once crenately lobed, tip truncate. Stipes 3 inches long, channelled (also rhachis), flexuous; the upper part very slender, almost filiform, straw-coloured, finely hairy, hairs patent; the lower portion much compressed, flat, dark-brown, sub-scaberulous. Scales subulate-lanceolate, much acuminate, ¾ inch long, red-brown, glossy, finely striate; margins slightly and distantly denticulate; cells numerous, linear-oblong.

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* This fern is, more recently, said to be identical with *Pt. incisa* of Thunberg, an earlier discovered African and Indian fern; hence the priority of that name.

† "Novæ-Hollandiæ Plant. Spec.," vol. ii., tab. 245.

Hab. Sides of Mount Tongariro, County of East Taupo; 1887: *Messrs. Owen and Hill.*

Obs. This species is peculiar, inasmuch as it is scarcely allied (or, if so, not closely) to any one of our known New Zealand species of this genus, including also the Australian ones with those of the neighbouring islands. In its soft herbaceous texture it approaches *L. nigra;* in its pilose character (slightly) *L. vulcanica;* in the position and shape of its lobes (but again only very lightly) *L. discolor;* perhaps its nearest ally is *L. vulcanica*, but from that species it differs considerably in several characters—as in size, colour, texture, cutting and shape of frond and lobes (particularly the lower pair of lobes and the terminal ones), in venation which is much branched throughout, especially in the terminal lobe, (and this character alone is a rather unusual one in this genus, although it obtains in a lesser degree in *L. nigra*,) and in its slender compressed stipe, and red-brown (not "black") scales. Unfortunately a fruitful frond has not been seen, and my only specimen appears to have been broken off at some distance above ground, being quite clean and free from earthy particles.

2. *L. aggregata*, sp. nov.

Rhizome (underground) long, 2–3 inches or more, narrow, woody. Root-stock (above ground) 1–2 inches, with many stipites and numerous blackish subulate scales; rootlets brown, long, fibrous, hairy, much branched; several perfect plants growing in separate tufts or heads from one root-stock. Plant small, tufted; fronds erect, spreading, 4–6 inches high, linear-lanceolate, pinnate, membranaceous, glabrous, green inclining to pale; stipes various lengths, ½–1 inch (sometimes, but rarely, 3 inches), very slender, channelled, minutely and thickly papillose, reddish-brown, scaly below at bases: sterile frond 3–5 inches long, 6–9 lines wide, pinnato-pinnatifid, the green lamina completely severed to rhachis (merely the extremely narrow white sub-cartilaginous translucent margin remaining, and so throughout); segments alternate sometimes opposite, free but close, sinuses broad, broadly oblong, (sometimes broadly deltoid, the upper margin horizontal, and apex very obtuse,) 2–4 lines long, sessile with a broad base extended upwards and decurrent, tips rounded; the lower segments small and semi-orbicular, sometimes narrow lunate; the terminal lobe ovate, obtuse; margins entire, slightly sinuate, narrowly cartilaginous, minutely and sharply serrulate (*sub lente*) at tips of veins with 2–3–4 microscopical teeth close together; midrib not extending to tips; veins few, pinnate, 4 – 5-jugate, simple and forked, extending to margins, slightly clavate: fertile frond, 2 inches shorter and narrower, the stipe usually longer, pinnæ few, alternate and opposite, 2–3 lines long, narrow-linear, much falcate or curved upwards, distant, sessile, and largely decurrent on rhachis; tips obtuse and mucronate; the ultimate lobe long and very narrow. Involucre narrow, not extending to tips, at first incurved, afterwards recurved and everted, margin entire. Sori brown, profuse, covering midrib and rhachis also when lobes opposite.

Hab. Sides of streams, and watercourses in low gullies, forests about Danneverke, County of Waipawa; 1887: *W.C.*

Obs. I. This little fern is closely and naturally allied to some other of our small *Lomariæ:* as *L. lanceolata*, Spr., *L. membranacea*, Col., *L. pumila*, Raoul, *L. oligoneuron*, Col., and *L. intermedia*, Col.;* but, as I take it, (after long and close comparison and study of the plants in their living state,) is very distinct from them all in several characters, yet forming with them a pleasing kind of natural sequence. At the same time, with Sir W. J. Hooker, I feel obliged to remark on the great and increasing difficulty or impossibility of making real distinctions and differences in allied ferns clearly known without accurate drawings.

II. I have described it as "pinnate," (and have given my reason for doing so,) other botanists may deem it to be pinnatifid; it is just one of those ferns that (to use Sir W. J. Hooker's words) "might with equal propriety be called pinnatifid or pinnate." ("Ic. Fil.," on tab. cxl.)

III. It grows plentifully in those habitats mentioned above; and with it, just as plentiful, its congener *L. lanceolata*, of various sizes. And while, at first sight, the skilled observer is liable to confound the two plants, (as I myself did,) yet he soon learns to distinguish them, even at a short distance.

3. *L. parvifolia*, sp. nov.

Fronds (sterile) including stipes, 7 – 9 inches high, 4 – 5 lines

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* "Trans. N.Z. Inst.," vol. xix., p. 274.

broad, linear-lanceolate, slender, weak, drooping, pinnatifid cut nearly to rhachis but the green lamina entire, membranaceous, glabrous, shining, pale-green with a reddish tinge; segments sub 30-jugate, symmetrical, alternate, distant, sinuses large, oblong, 1½ lines long, 1 line broad, obtuse (sometimes sub-acute from the tip of a vein); the ultimate lobe rather large, confluent, obtuse, margins entire and sub-sinuate from tips of veins, segments very distant below and sub-pinnate, bases extending upwards and decurrent; midrib flexuous, evanescent; veins very few, pinnate, 2–3-jugate, simple, prominent, extending to margin, their tips thickened, brown. Stipes very long, about half the length of the whole frond, very slender almost capillary, flexuous, finely channelled above, dark-red-brown, glossy, with a few short, sub-orbicular thin reddish scales at base.

Hab. High slopes of Tongariro Mountain Range, County of East Taupo; 1887: per *Mr. H. Hill.*

Obs. This is a most peculiar species; its long, narrow, slender, small-leaved fronds differ widely from all its congeners known to me. Unfortunately I have not seen a fertile frond, but have received several barren ones entire, and they are nearly alike. Apparently the plant is of cæspitose growth. Perfect specimens of this little species are much desired.

4. *L. fluviatilis*, Sprengel; var. *ramosa*, Col.

Plant similar to *L. fluviatilis* (as found here and in the hilly interior of the North Island), large, gregarious, forming thick beds or patches; caudex stout, 4–6 inches high, coalescent of many stipites. Stipes 4–7 inches long, rather slender, very scaly throughout (as also rhachis) with long red glossy scales. Fronds linear-lanceolate, 2 feet 3 inches to 2 feet 6 inches long, 1–1½ inches broad, pinnate, membranaceous, light-green. Sterile fronds: spreading, somewhat decumbent, pinnæ 50-jugate, distant, orbicular, and oval with broadly rounded tips, ½ inch long, slightly narrowed at base, sessile, patent; midrib not extending to apex; veins pinnate, prominent, forked; margins cartilaginous, white, denticulate, recurved; the uppermost lobes very small and pinnatifid, confluent at tip; forked and branched near the top; branches 4–6 inches long, dichotomous at tips, branchlets 1–2½ inches long, very narrow; pinnæ as on rhachis but much smaller and gradually reduced in size, minute at apices; sometimes the extreme tips of the branchlets bear long narrow fruiting lobes or pinnæ; and sometimes their tips are corymbose-crested and much dilated,* with their lobes close and imbricated; more rarely a single narrow linear obtuse leaflet, or lobe, 2 inches long, is produced from the main rhachis at the base of a branch. Fertile fronds: the pinnæ are shorter, narrower, and more distant on rhachis than in *L. fluviatilis;* they are also forked and dichotomously branched near their tops; branches 6 – 7 inches long, very narrow, flexuous, and curved; the pinnæ small, 2 – 4 lines long, very numerous. Sori copious; involucre large, laciniate at margins; brown, very cellular.

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* As shown in *L. spicant*, var. *ramosum*, Moore: Lowe, "New and Rare Ferns," plate xxi.

Hab. Dry forests near Norsewood, County of Waipawa; 1882–86: *W.C.*

Obs. I. I have long known this pretty variety of *Lomaria* (for such I deem it,) and have, also, shown specimens of it at the meetings of our Society; and for some time have been undecided whether to describe it as a *sp. nov.*, or only as a variety of *L. fluviatilis.* I was the more inclined to make it a *sp. nov.* from the manner in which Raoul and other botanists have described *L. fluviatilis*, (*L. rotundifolia* of Raoul,) including also their drawings of that plant, evidently showing it to be a much smaller and shorter yet wider-fronded fern; but, on the other hand, there was also my own still earlier description* of it than Raoul's; which, in the main, agrees with this, the large *L. fluviatilis* of our Hawke's Bay and interior forests.

II. M. Raoul discovered his fern at Akaroa (South Island), and describes it fully as a *sp. nov.* In his description he says:—"Frondes confertissimæ, ... breviter stipitatæ, oblongo-lanceolatæ; 2–2½ decimetr. longa. Pinnæ (v. lobi) 14–20." (*loc. cit.*, p. 9.) And his drawing of a small fern, in his folio work, agrees with his description.

III. Sir J. D. Hooker also, in his "Flora Tasmaniæ," gives a similar drawing, though a little larger, of the Tasmanian plant, with very short and almost glabrous stipes, and glabrous rhachises. In his description he says: "Fronds 8–18 inches high, with very short stipes," etc. In my description, I had said, "This fern in its native forests presents a very graceful appearance. It there attains a large size, some fronds having been observed between 2 and 3 feet in length. The fertile fronds, generally 8 in number in each plant, are invariably very erect, ascending directly from the centre; while the numerous barren fronds, spread out horizontally in a half-procumbent manner, enchant the eye of the observer with a most elegant circle of delicate and ever-living green" (*loc. cit.*).

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* I first met with this fern in "December, 1841, in humid woods near Waikare Lake, North Island;" and an early description of it (with others) was published in 1842, in "The Tasmanian Journal of Natural Science," vol. i, p. 377, under the name of *L. rotundifolia*, Col. M. Raoul was also in the spring and summer of that same year (1841), at Akaroa, South Island, where he detected his fern; and again there in 1842-43, returning to France in August, 1843; and soon after he published his "Choix de Plantes de la Nouvelle-Zélande," in which he, too, knowing nothing of mine, named his fern *L. rotundifolia*, Raoul. Sir W. J. Hooker, however, in his "Species Filicum," subsequently published it as being the *L. fluviatilis* of Sprengel, who I fancy had never seen a New Zealand specimen of it, but only a Tasmanian one—viz., the *Stegania fluviatilis* of R. Brown.

IV. Those two ferns (the New Zealand South Island and Tasmanian ones) are very dissimilar at first sight from our Hawke's Bay, North Island, one; but on close investigation they are not, I think, specifically distinct. It is, however, a pity that we have only drawings of such small dwarfish specimens to represent our tall, fine, and graceful fern—certainly the most handsome of the genus inhabiting New Zealand.

Genus 18. **Asplenium**, Linn.

§ A. Euasplenium.

1. *A. melanolepis*, sp. nov.

Plant small, tufted, erect, 10–15 fronds; with numerous small erect subulate black scales at extreme bases of stipites, growing like a little fringed crown among them; roots many, rather short, wiry, chestnut-brown, hairy. Stipes ½–3 inches long, red-brown, glossy, rather slender (sometimes filiform), brittle, sub-cylindrical, flattish on upper surface, narrowly margined (also rhachis), with a few scattered weak brownish scales near base. Fronds linear-lanceolate, pinnate, 4–7 inches long, 4–6 lines wide (at broadest part), flexuous, spreading, green inclining to pale; pinnæ 20–30 pairs, small, 2–2½ lines long, 1–1½ lines broad, decreasing gradually in size to apex, terminal pinnæ not confluent; petiolate and distant throughout, very distant and minute below, mostly opposite and sub-opposite sometimes alternate, sub-coriaceous and opaque, margined, margins slightly recurved; generally of two principal forms on a frond, (1) those below sub-orbicular-flabellate and rhomboidal, their outer margins pretty regularly bluntly crenate, and their upper and lower basal margins nearly equal; (2) those above sub-obovate-oblong and narrow-oblong, their sides very unequal, the lower margin nearly straight and entire, the upper curved, slightly and irregularly crenulate, and abruptly excised at base, their tips truncate and crenate; veins 3-nerved, flabellate in lower pinnæ; in upper pinnæ few, almost obsolete, with scarcely a midrib; tips very slightly clavate and not extending to margins. Sori near margin but irregular in position and in size, form, and number,—1, 2, 3, 4, or 5 on a pinna,—sometimes a single globose cluster (like *Polypodium*), and sometimes confluent, filling the under-surface of a pinna; often the smaller oblong pinnæ contain the larger number of sori. Involucre linear, narrow, white, persistent, margin entire. Scales subulate, 3 lines long, much acuminate, flexuous, with a thick central black nerve and largely reticulated membranous margins; cells large, their walls thick and black.

Hab. Among crags on the summit of the high hill Pukekotuku, near Puketapu, County of Hawke's Bay; 1859: *W.C.* Petane Valley, north of Napier, same county; 1881: *Mr. A. Hamilton.*

Obs. I. This fern is pretty closely allied to the two well-known British species *A. trichomanes* and *A. viride*; also, (though more remotely) to the New Zealand species *A. flabellifolium*, and it naturally belongs to the same section and group (*Euasplenium*); but, while it possesses a very strong sectional likeness, it is very distinct from them all in several grave characters—as colour of frond and stipe, shape, size, substance and position of pinnæ, their peculiar venation, the form and place of sori, and their small, narrow, and persistent involucre, and the highly curious basal scales.

II. I have long known this plant, and, though I have several times taken it up for examination, I set it aside, thinking it to be a variety of *A. trichomanes*, or of *A. viride*, or a hybrid between them and *A. flabellifolium*, if those two British species (*veræ*) were also denizens of this country. I have now, however, thoroughly and exhaustively examined this plant, having plenty of good specimens, and also standard drawings, with dissections,* of those two British species (*supra*); and the result I have here given in my rather long and close description of this fern. With me, such an amount of differential and important characters, found, too, on so many specimens, settles the matter.

III. Some of my specimens of this fern are, to say the least of them, "sportive"—their rhachises largely forked at tips with a long terminal pinna; others possessing a few very long and scattered ligulate pinnæ, 8–10 lines long, but scarcely regular enough to be deemed a variety.

2. *A. flabellifolium*, Cav., var. *ramosum*, Col.

Plant tufted, 6–9-fronded, prostrate, spreading. Stipe light-green, slender, glabrous (also rhachis), 2–5 inches long. Frond dark-green, pinnate, main rhachis 10–14 inches long, subflexuous, branched above; tips long, filiform, naked, proliferous; branches very slender, straight, 4–7 inches long; pinnæ petiolulate, free, alternate, (the lowest pair opposite,) 18–24 on each side of main rhachis, 3–8 lines long, 2–5 lines broad, of various sizes and shapes:—(1) broadly deltoid, and 3-lobed ovate or bluntly sub-hastate with very obtuse rounded tips: (2) quadrilateral: (3) trapeziform: (4) ovate-acuminate with proliferous tips,—their margins sharply toothed, the posterior lower base excised, sometimes both; midrib flexuous; veins pinnate; veinlets simple and forked, vanishing at tips and not extending to margins; trinerved in the broadest pinnæ. Sori numerous, biserial, 8–6 pairs on a pinna, nearer costa than margin, opposite, oblique, distinct not confluent, sometimes an additional smaller sorus, or even 2, on auricle of larger pinnæ. Involucre pale, rather large, adpressed, sub-lunulate-linear, finely reticulated (*sub lente*), margins entire but slightly sub-sinuate. Capsules large brown shining, not numerous, scarcely appearing from beneath open margin of involucre.

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* I may especially mention (for drawings, etc.,) Sir W. J. Hooker's "British Ferns;" Sowerby's "English Botany;" Newman's "British Ferns;" Bentham's "British Flora;" and Beddome's "Ferns of South and of British India;" also, for additional descriptions, "Species Filicum," Hooker; "Synopsis Filicum," Baker; and the description of *A. trichomanes* in "Flora Australiensis," etc.

Hab. Woods near the town of Waipawa; 1882: *Mr. A. Hamilton.*

Obs. A striking variety of a well-known and elegant New Zealand fern; peculiar in its branching and in its highly abnormal and varied pinnæ on the same frond; and still further differing from *A. flabellifolium* in the disposition of its veins and sori.

Genus 20. **Nephrodium**, Br.

§ EUNEPHRODIUM.

1. *N. inæquilaterum*, sp. nov.

Rhizome subterranean, long, creeping, flexuous, woody, sub-angular-cylindrical, as thick as a common lead pencil, with many rootlets, blackish. Vernation erect, uniserial, distant 1–1½ inches on rhizome. Stipes 6–7 inches long, rather stout, sub-cylindrical, channelled above, (as, also, rhachis and sub-rhachises,) straw-coloured, blackish at base, glabrous. Fronds, 5–8 (rarely 9–10) inches long, 3–6 inches broad at base, ovate and sub-deltoid-ovate, acuminate, sub-membranaceous, green, glabrous, somewhat glossy, with a few small broad inflated brown scales scattered on rhachis and sub-rhachises; pinnate, pinnæ few 8 – 12-jugate, opposite, free, not close, very distant below on rhachis, 1–1½ inches apart, the lowest pair of pinnæ very little shorter than the pair above, petiolate, linear-lanceolate-acuminate, 2–3 inches long, 4–5 lines wide, tip acute, spreading, straight, sometimes approximate, pinnatifid, one-third cut to rhachis; lobes small, regular, attenuated, sub-deltoid, unequilateral, the lowest posterior basal lobe wanting as if the pinna was excised; tips falcate or curved with a small mucro; midrib flexuous; margins entire, slightly cartilaginous, white, recurved; the terminal pinna 2 inches long, its lobes larger than those of pinnæ, tip very acuminate. Veins of lobes conspicuous, translucent, reddish, pinnate, 6 – 7-jugate, curved and extending to margin, besides the lowermost vein which starts from extreme base of midrib on the anterior side and makes an angle with a much shorter vein that meets it from sub-rhachis of pinna on the posterior side directly under the sinus, and so forming a costal anastomosing unequilateral venule between the lobes, enclosing a narrow triangular costal areole; the lower (or 2nd) pair of basal veins scarcely meet at the sinus, usually appearing at the margins just above it, to which also a long straight veinlet is carried from the outer angle of the said costal areole. Sori many, nearer margin than midrib, sub-marginal, close, confluent in age, occupying lobes from tips to far below sinus and nearly to sub-rhachis, unequal in number on a lobe, usually 6 on one side and 7 on the other, much more numerous (8–10 pairs) on lobes of the terminal pinna, also on upper smaller pinnæ. Capsules profuse, dark-brown, glossy. Involucre large, persistent, sub-orbicular-quadrate, somewhat dilated, membranaceous, white at first becoming brown in age, shining, closely filled with many dark crinkled veins; margins much sinuate, ciliated; ciliæ jointed. (Resembling those of *N. funestum*, Hook., and *N. squamigerum*, Hook. and Arn.: "Sp. Filicum," vol. iv., tabs. 259, 270.)

Hab. Woods near Tapuaeharuru, County of East Taupo; 1872 (received from a visitor): Wairakei, same county; 1887: *Mr. C. J. Norton.*

Obs. A few years ago I received several fronds of this fern from an acquaintance, who was sojourning for his health among the hot baths in the Taupo District; but unfortunately they were all barren. At the time I thought the fern would prove distinct from any known and published ones; at all events, they were then new to me. Recently, however, through the kindness of Mr. Norton, I have received several fruiting specimens, and I now find them, after long and close examination, to be as I had supposed. The fern, however, is not wholly new to collectors and others, it having, I believe, commonly passed with them as *N. unitum*, Sieb., from which species, although allied, it is certainly quite distinct, and that in several characters: as in its very much smaller size and different shape; the pinnæ few, petiolate, distant and not contracted at base,* their lobes oblique and peculiarly unequal-sided; fewer veinlets, with only one basal pair uniting and forming a long narrow costal areole; sori also in unequal series on the lobes; and the involucre large, persistent, differently shaped and ciliate. All these characters are the opposite of those of *N. unitum*; as given respectively by Sir W. J. Hooker, Bentham, Baker, and Beddome; while the drawing of *N. unitum* with dissections ("Beddome's Ferns of South India," tab. 78) shows a very different plant. So also his drawings of other closely allied species, as *N. terminans*, J. Sm., *N. propinquum*, Br., *N. extensum*, Hook., and *N. pteroides*, J. Sm. (*loc. cit.*), all of them being also Australian ferns, and much nearer to *N. unitum* than any of them are to this species. Having had plenty of good specimens, and that, too, in their fresh state, with ample works of reference at hand, I have, I trust, fully settled this inquiry.

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* Sir W. J. Hooker says of *N. unitum*: "fronds 1–2 feet long, suddenly contracted and attenuated at the base by the dwarfing of the pinnæ there." ("Sp. Filicum," vol. iv., p. 81.) And this is also clearly shown by Beddome in his drawing of that species. Further, I am well aware of what Baker says ("Syn. Filicum," pp. 289–290) respecting the *N. unitum* of Sieb., and of Hook.; that it is a different fern from *N. unitum* of R. Br.; and he also gives separate descriptions of both, making of the former fern a distinct species, *N. cucullatum*, Baker. Moreover, this is supported by Clark in his more recent work, "Review of the Ferns of Northern India" ("Trans. Linn. Society of London," 1880; 2nd series, Botany, vol. i., part viii.), but all that makes no difference, as far as regards this New Zealand fern here described, as it is equally distinct from both.

Genus 21. **Nephrolepis**, Schott.

1. *N. flexuosa*, sp. nov.

Caudex subterranean, erect, 6–8 inches (or more) long, composed of a harsh somewhat woody flexuous rhizome, some broken stipites and many long wiry rigid branching and spreading glossy rootlets; vernation fasciculate. Stipes 3–6 inches long, semi-terete at top, cylindrical at base, slender, brittle, reddish, glossy, hairy. Fronds erect, mostly 12–20 (sometimes 23–26) inches high, linear-lanceolate, attenuated above and below, tip acute; rhachis slender, channelled above, brown, shaggy with long flexuous red fimbriate scales or compound hairs; pinnate, usually 1 – 1¼ inches wide (sometimes 1½ – 1¾ inches) at the widest part, green, glabrous, glossy, with cretaceous dots on upper surface directly over the clavate tips of veins; pinnæ varying in number on a frond from 60 to 100, and even to 140 (rarely) on each side of rhachis, ½ inch long, 2–2½ lines wide, alternate, distant (sometimes close-set), obliquely-oblong, tips broad; very small above at apex, small and orbicular and very distant at base; patent, upper margin straight sometimes very slightly curved; midrib dark-coloured, flexuous, not reaching to apex of pinna, sub 3-branched at base; margins somewhat crenate-incised with few distant irregular incisions, their outer edges straight; tips rounded crenate; anterior base of pinnæ largely auricled upwards, auricle cordate, rounded, entire and imbricating rhachis, its margins recurved; the posterior base scarcely sub-cordate, often slightly excised; petiolulate, the petiole inserted in an oval excavation in the epidermis of the rhachis, with additional hairs at the junction. Veins rather obscure, few, free, 12 – 16-jugate in larger pinnæ, bases dark as midrib, forked only, not extending to margins; tips orbicular, clavate. Sori large, biserial on the upper part of pinnæ on the anterior veinlets, nearer margin than costa, always more in the upper row, usually 7–5 (6–3, and so on), the uppermost pinnæ with sori in one row only; capsules small, dark-coloured, on very long pedicels. Involucres of various shapes—reniform, lunate, and hippocrepiform, persistent, very membranaceous, whitish, finely reticulated with dark veins, transparent, glossy, margins entire and sinuate, opening towards apex of pinna, except 2 (sometimes 3) basal ones in the upper row which open towards lateral margin. The compound scales or flattened hairs on the rhachis are very peculiar, brown, sub-ovate and largely fimbriate at base, with long curly white tips, their basal fimbriæ also very curly.

Hab. Banks of a hot stream at Tapuaeharuru, near Taupo township; and in the neighbourhood of hot springs at Wairakei, near the River Waikato, west bank; both places in the County of East Taupo; 1887: *Mr. C. J. Norton.* [My first specimens I received from the interior (exact locality unknown), in 1861: *W.C.*]

Obs. I. I have known this fern for several years (26), but only from imperfect specimens, yet I ever doubted it being *N. tuberosa*, Presl. Lately, however, I have received a quantity of good specimens from Mr. Norton, and now, after a prolonged and close examination, aided by the works of our first pteridologists, I feel assured that it is a different species from *N. tuberosa*, Presl., as that fern is described and figured by them.

II. The latest critical authority on Indian ferns known to me is Mr. G. B. Clarke ("Trans. Linn. Soc., 2nd series, Botany," vol. i.), who both describes *N. tuberosa*, Presl., (*l.c.*, p. 540,) and refers to Beddome's figures of it ("Ferns of Southern India," tab. xcii.); the fern there figured and dissected is utterly unlike this one described by me,—in outline, in size and shape and cutting of pinnæ, in midrib and venation, and in sori. J. Smith ("Ferns Brit. and For.," p. 164,) refers to "Lowe's Ferns," vol. vii., tab. 25, for *N. tuberosa*, Presl.; that figure too, is very far from this fern. I cannot reconcile Bentham's description of *Aspidium* (*Nephrolepis*) *cordifolium* = *N. tuberosa* of authors, ("Flora Austral.," vol. vii., p. 754,) with this New Zealand fern; neither does it agree with Swartz's brief description of *Aspidium cordifolium,* with which fern Bentham has united it. In Sir W. J. Hooker's carefully detailed specific description of *N. tuberosa*, Presl., ("Sp. Fil." vol. iv., p. 151,) I find grave differences of character, distinguishing it from this fern. Of that fern he says: "fronds *glabrous*, pinnæ *crenated*, auricle *acute*," [as also shown in Beddome's figures,] "sori *equidistant*, opening *towards apex* of pinna, involucre *reniform nearly half-moon*-shaped, *firm*, *coriaceous*, base *black*," etc. And Baker ("Syn. Fil.," p. 300,) says of *N. cordifolia*, Presl.:

"rhachis *slightly scaly*, involucre *firm*, *distinctly reniform*," etc. To which I would add Moore's remark on *N. tuberosa*: "Indusium *reniform* affixed by its *oblique arcuate base*;" which, also, his figure of it shows. ("Ind. Fil.," p. xc.; tab. 72, B. 5.) All those characters do not agree with these of this species (*vide descr.*), besides other positive important ones peculiar to it. Lowe (*l.c.*) gives no less than eight plates of as many distinct species of *Nephrolepis*, all differing from this one; the nearest, however, of them to it is *N. pectinata*, Schott (tab. 18,) but only in a distant resemblance. I notice this species is made by Baker (*l.c.*) a var. β of *N. tuberosa*, Presl.

III. As the species of *Nephrolepis* described by Sir J. D. Hooker[*] is in the same characters (abbreviated) as in "Sp. Fil." (*supra*), it is, of course, a different species from this one, and it was obtained from a very different locality in New Zealand; so we now possess two (or more) species of this small genus[†]; three (or more) species are known from Australia.

Genus 22. **Polypodium**, Linn.

1. *P.* (*Goniopteris*) *subsimilis*, sp. nov.

Caudex erect, 1 foot to 1 foot 6 inches high, rather slender, coalescent. Vernation fasciculate, many fronds together, suberect, free, spreading. Stipes 2 – 3 inches long, rather slender, very scaly; scales large, ovate, cordate, peltate, obtuse, brown, 2 – 3 lines long, with large hexagonal cells. Fronds 10 – 12 (rarely 16) inches long, 4 inches broad at middle, oblong-lanceolate, pinnate, membranaceous, dull-green blotched with red, somewhat glossy above in a longitudinal line along centre of pinnæ, rhachis slender, deeply channelled above, reddish, very hairy (also sub-rhachises, costæ, and veins); hairs short, with scattered broadly-ovate adpressed brown scales on rhachis, sub-rhachises, and veins below; pinnæ petiolate, free, opposite, rather distant, horizontal, spreading, sub-linear-lanceolate, 2 inches long, 4 lines wide, broadest at base, tips acuminate, acute; pinnatifid, cut ⅔rds to sub-rhachis; lobes narrow-oblong, obtuse; margins entire, slightly cartilaginous, ciliate; ciliæ red; the basal pair of lobes on sub-rhachises much larger and pinnatifid, their veins bipinnate; the lowest 3 – 5 pairs of pinnæ much shorter and broader, ovate, obtuse, 1 – 1¼ inches long, ¾ inch wide at base, each pair about 1 inch apart on rhachis. Veins prominent below, pinnate, simple, usually 7 – 8 pairs in a lobe (5 – 6 pairs only in the lobes of lower short pinnæ), the lowest veinlet uniting with the opposite one and both sending out a straight veinlet to the sinus; but in the lobes of the upper pinnæ the lower pair of veins are curved and barely meeting at the sinus. Sori small, reddish, nearer costa than margin.

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[*] "Handbook N.Z. Flora," p. 379.

[†] Sir W. J. Hooker gives six species ("Sp. Fil."); Baker gives seven ("Syn. Fil."); Lowe (as we have seen) gives plates of eight, and mentions others; and J. Smith ("Hist. Fil.") gives twelve species of *Nephrolepis*.

Hab. Sides of streams, forests near Matamau, County of Waipawa; 1882–83: *W.C.*

Obs. I. This fern is nearly allied to *P.* (*G.*) *pennigerum*, Forst., with which, at first sight, it is likely to be confounded and taken for a small plant of that species; but a close examination reveals its difference in several characters—viz., the very much smaller size, narrower and slenderer in all its parts, its excessive hairiness, with peculiar large scales scattered on its frond, and the lobes ciliated; the pinnæ distant, very narrow and largely petiolate, with only the lowest veinlet of the lobes uniting, and the basal lobes large and pinnatifid with bipinnate veins. By some botanists, however, it may be considered as merely a variety of *P. pennigerum*, like two others (varieties) I have described.*

II. This fern is rather scarce, I having met with it in profusion in only one spot, where, however, were several low arborescent plants of it growing together, forming a little thicket or tangled brake, and certainly looking very pretty and neat.

ART. XXIX.—*On new Indigenous Cryptogams, of the Orders* Lycopodiaceæ, Musci, *and* Hepaticæ.

By W. COLENSO, F.R.S., F.L.S., Lond., etc.

[*Read before the Hawke's Bay Philosophical Institute, 17th October,* 1887.]

ORDER II.—LYCOPODIACEÆ.

Genus 2. **Lycopodium,** Linn.

§ III. Leaves imbricated all round the stem. Spikes terete, peduncled.

1. *L. scopulosum*, sp. nov.

Plant small, erect, 2½–3 inches high, dichotomously branched, branches spreading. Main stem wiry, slender, rigid, ¾ inch long, bare; forked from underground (and without roots to specimens), the two lower branches also bare below for about ½ inch each, twice forked above, each of the forkings again divided into 4 equal branchlets, sub 1 inch long, cylindrical and densely leafy throughout. Leaves somewhat sexfariously closely adpressed, erect, imbricate, linear-acuminate, sub-cylindrical compressed, flattish on one side, convex on the other, 1½ lines long, pale yellow-green, shining; tips very long, acute and reddish. Peduncles terminal, single, erect, ½ inch long, slender, sub-cylindrical, striate, with a few yellow cauline bracts as long as leaves, narrow, ovate-acuminate, flexuous and squarrose, distant and scattered below, sub-verticillate (about 4 together) above. Spike 1 inch long, cylindrical, scales sub-peltate, sexfariously arranged, very close and imbricate, ovate-acuminate, yellow with a blackish central stripe, adpressed below; veins closely anastomosing, apparent when held up between the eye and light; margins finely erose wavy and recurved; tips spreading squarrosely. Capsule wider than scale, orbicular-reniform, pale yellow.

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* Vars. *hamiltonii*, and *giganteum*, "Trans. N.Z. Inst.," vol. xiv., p. 338, 339.

Hab. Lava beds, base of Mount Ngaruahoe, County of East Taupo; "altitude 3,000 feet;" 1887: *Mr. H. Hill.*

Obs. I. This little plant is somewhat allied to *L. clavatum* var. *magellanicum* (of the "Handbook N.Z. Flora"), but differs from that species in its stem not being creeping below, and in not being fastigiately branched; in its small slender few-leaved (almost bare) peduncles, and in its scales being of a different shape, narrower and entire at their bases, etc.

II. *L. clavatum* var. *magellanicum*, is also said by Hooker (*loc. cit.*) to be identical with *L. pichinchense* (Hook. "Ic. Plant.," tab. 85), and, in "Flora of New Zealand," it is further said to be identical with *L. heterophyllum*, Hook., ("Ic. Fil." tab. 113). I have closely examined those drawings, and also that of *L. clavatum*, Hook. ("Brit. Ferns," tab. 49, and Sowerby's "English Botany," tab. 1451,) and find this plant to have no close affinity with them; in fact, to differ considerably in several characters. I have received three specimens of this plant, that are pretty nearly all alike in size and ramification, all dichotomously spreading; two of them being good fruiting specimens—one, 8-branched above and bearing 4 single spikes, and one, 6-branched with 2 single spikes.

2. *L. curvifolium*, sp. nov.

Plant, rhizome or main stem "creeping on the surface of the ground." Stems erect, 10–12 inches high, slender, wiry, hard, whitish, distantly leafy, leaves somewhat sub-verticillately disposed; sparingly branched. Branches sub-erect, alternate, 3–5 inches long, sub-flabelliform, much branched above, very leafy throughout; branchlets dichotomous, slender, 2–3 inches long, sub-erect. Leaves loosely imbricating all round, flat, very narrow, linear-acuminate, 2 lines long, (larger ones on main stems 3–3½ lines long, very distant, and sub-appressed,) decurrent, spreading, patent, curved; tips ascending, acute. Spikes terminal on main branches, panicled; panicles sub-fastigiate, 2–4-branched, bearing 3–8 spikes on long slender pedicels, that are sparingly leafy as on main stems, but leaves smaller; spikes usually 2 together, or 3, or only 1, sometimes bifid or forked, 1½–1¾ inches long, very narrow, about 1 line wide, sub-cylindrical; scales quinquefariously disposed, imbricate, peltate, narrow-ovate-acuminate, brown on centre outside; margins waved, minutely denticulate; tips acute and obtuse, spreading. Capsule large, pale greenish-yellow, broadly and transversely oblong or sub-quadrilateral; valves, margins wavy and slightly erose. Spores white, semi-elliptic, roughish.

Hab. High lands, "altitude 2,000 feet," north of Gisborne, County of Cook; 1887: *Mr. W. K. Chambers.*

Obs. This species has a very pleasing miniature tree-like appearance, somewhat resembling some specimens of another New Zealand *Lycopodium*, *L. densum*, Labill., but more neat and finely cut, to which species it is also pretty closely allied. From that species, however, its larger more distant and less imbricated curved leaves, its longer and narrower spikes, which are also panicled, and mostly 2 or even 3 together on long slender pedicels, and its peculiarly-shaped capsule abundantly distinguish it.

§ IV. Leaves distichous. Spikes terminal, terete.

8. *L. distans*, sp. nov.

Plant "creeping, spreading on surface of the ground;" main stems "long, rooting at nodes." Secondary stems erect, straight, "4–6 inches apart," 6–8 inches high, sub-cylindrical, slender, woody, irregularly and deeply channelled on the upper surface, leafy, much branched. Branches flat, spreading, sub-flabellate, tri-quadri-pinnatifid; branchlets dichotomous, 2–3 inches long, 2½–3 lines wide; tips forked, divergent. Leaves distant throughout, (those on secondary stems very distant, 3–4 lines apart, sub 2 lines long, obtuse,) regularly disposed, alternate, coriaceous, glabrous, wrinkled, light-green on both sides, of two kinds: (1) the larger, patent, triangular, curved, falcate, tips acute, incurved, largely decurrent; (2) the smaller on under-surface only, sub-tristichous, the lateral ones arising from the decurrent bases of the larger leaves, the central from the middle of stems, linear-acuminate, sub 3 lines long, their bases appressed; tips acute, wavy, scarious, spreading, appearing above in the interspaces between the larger leaves. Peduncles very long, 2–4 inches, slender, erect, simple, forked, dichotomous and trichotomous, leafy; leaves or bracts long narrow, acuminate, erect, scattered, semi-appressed; tips spreading, scarious, membranaceous, jagged, acute. Pedicels 1–3, similar to peduncles, 1–2 inches long, spikes narrow, compact, 1–1½ inches long, 1–1½ lines wide, tips obtuse; scales broadly deltoid acuminate, their centres green and somewhat turgid, margins yellow, membranaceous, denticulate and wavy; tips long, acute, patent, decurved, their edges finely serrate-cut. Capsules yellow, broader than scales, margins sub-sinuate, entire, the inner valve larger. Spores white, orbicular and sub-orbicular-cordate, much echinate, their trilateral suture strongly marked.

Hab. High lands, County of Cook, with preceding; 1887: *Mr. W. K. Chambers.*

Obs. 1. This is a fine stout leafy species; it has near affinity with *L. scariosum*, Forst., (also a New Zealand *Lycopodium*,) but differs from that species in several particulars: as in the tips of its branchlets being forked and divergent; in its more distant leaves that are also unicoloured; in the smaller ones (or stipules) being subtristichous, longer, and much more acute; in its very long peduncles; in its narrow and long spikes, with differently shaped acuminate scales, and broader capsules extending laterally beyond them; and in its globular echinated spores.

II. This plant, from its somewhat resembling at first sight *L. scariosum*, has caused me some considerable exercise in a series of long, close, and repeated examinations. Fortunately, I have received specimens of it in various stages and sizes, with, also, full descriptions of *L. scariosum* by several celebrated botanists, and drawings with dissections by Sir W. J. Hooker of *L. scariosum*, Forst., var. *decurrens*, Br., and of *L. jussieui*, Desv., which two plants Sir J. D. Hooker says, in his description of *L. scariosum*, are identical with it ("Handbook, Flora N.Z."). There is, however, very little, if any, close affinity between those two drawings and this plant here described (or even between those two drawings themselves). Bentham ("Flora Australiensis") describes the spikes of *L. scariosum* as being "sessile, about ½ inch long; bracts (or scales) in four rows," etc., agreeing with the figure of *L. scariosum* var. *decurrens*, Br. (*supra*), which species and name he also refers to as a synonym; but he does *not* retain *L. jussieui*, and, as I think, rightly, for they are apparently very distinct. I again have much pleasure in recording the able and ready assistance kindly rendered by Dr. W. I. Spencer, F.L.S., in examining and determining its spores.

Genus 4. **Psilotum**, Swartz.

1. *P. heterocarpum*, sp. nov.

Plant terrestrial; rhizome hypogæous, shortly creeping, 3–4 inches long, slender, cylindrical, slightly branched with short thickish rootlets, hairy; hairs crowded, short, patent, clavate-tipped, red. Vernation erect, 7–9 inches high, sub-cæspitose, 6–10 stems rising nearly together, sometimes 3–4 stems uniserial and distant from a single rhizome; main stem stoutish, 1 line diameter, somewhat rigid, sub-cylindrical, bare of branches but much branched at top, leafless, with small scattered linear obtuse scales about 1 line long, smaller and more numerous on branches. Frond 4–5 inches long, spreading, flabellate, dark-green minutely speckled with whitish dots, glabrous, glossy; branches largely dichotomous, sub-angular (as also branchlets); branchlets numerous, very slender, less than ¼ line wide, long, straight, spreading, flexible; tips truncate, retuse and slightly emarginate. Capsules rather numerous, alternate, lateral and peduncled, mostly on the middle branches (not below, rarely at the tops), very small, $\frac{1}{20}$th inch diameter, sub-globose and slightly tri-lobed depressed, sometimes plain, also elliptic longer than broad, 1–2–3- and 4-celled, green at first (same colour as frond) and very glossy, orange-yellow when ripe, minutely dotted (*sub lente*), sometimes with 2 very small ovate obtuse lobes, or a minute bract, closely adpressed at base; peduncles short, about 1 line long, stout. Spores white, narrow oval.

Hab. Wairakei, Taupo, near the River Waikato, in ground heated by hot springs, among thick growing shrubs of *Leptospermum*, etc.; 1887: *Mr. C. J. Norton.*

ORDER IV.—MUSCI.

Genus 37. **Mnium**, Bruch and Schimp.

1. *M. xanthocarpum*, sp. nov.

Plant creeping, straggling; main branches 3–4 inches long, tips proliferous, hairy; branches sub-erect, ½–1 inch high, bare below and hairy. Leaves few, sub-rosulate at tips of branches, oblong, obtuse (sometimes slightly retuse,) apiculate, 2¼–3 lines long, (recurved and crisp when dry,) narrowly margined, margin entire but slightly uneven, sometimes minutely and sparsely denticulate towards apex, upper basal half free from stem of branch; nerve stout percurrent; dark-green, (pale in age,) sub-opaque; cells sub-orbicular-oblong with double walls, smaller and crowded at apex. Fruit-stalk erect, 15 lines long, stout, firm, yellow-green, base red, 1–4 growing together. Capsule oblong-cylindrical, 1½ lines long, sub-rugulose, horizontal and cernuous, yellow with dark orange rim at mouth. Operculum broadly conical, obtuse, much shorter than capsule, $\frac{1}{12}$th inch long, minutely papillose, orange. Teeth, external, brown, with 4 longitudinal lines, the transverse bars in pairs; internal, pale brown with distant bars and 4–6 large areoles in each tooth, very acuminate, filiform and knobbed, tips flexuose; the intervening ciliæ single and forked above with long filiform knobbed tips. Calyptra not seen.

Hab. Wet shaded forests near Norsewood, County of Waipawa; 1886: *W.C.*

Obs. This species is closely allied to *M. novæ-zealandiæ*,* Col., and also to *M. rostratum*, Schw., and *M. rhynchophorum*, Hook. From the former of those three species it differs in its smaller and dark-green leaves with narrower margins and small crowded cells at their tips; in its bearing 3–4 fruit-stalks, and its smaller and narrower capsule, which is also roughish, and yellow with an orange-coloured mouth; in its internal teeth being largely perforated, with long flexuous tips and their intervening ciliæ only single and forked at top; and in its operculum being much shorter than the capsule, of a different shape, orange-coloured and papillose—all which differences also apply more or less to the two other species named above.

Genus 46. **Polytrichum**, Linn.

§ V. Phalacroma, Hook. f. and Wilson.

(Stem tall, fastigiously branched, dendroid.)

1. *P. tongariroense*, sp. nov.

Plant erect, 8–10 inches high; stem long, simple below, much branched at top. Root (specimens) sub-horizontal, 1¼ inches long, 2 lines thick, curved, densely covered with white wool. Stem slender, straight, and flexuous, 5–6 inches high, brown, glossy, triquetrous and regularly scarred below, clothed above with sheathing imbricated closely adpressed scale-like leaves, their vaginant bases large, oblong-quadrate, 1½ lines long, 1 line broad, very glossy, nerve stout, prominent on outside (not broad), excurrent and forming the aristate leaf, 1 line long, increasing in size upwards on stem to 2 lines long, curved, acute, very slightly serrulate (*sub lente*); the top or branched part 3–4 inches long, containing 15–17 alternate and distant branches; branches simple, 2–2½ inches long, sometimes the lower ones are forked near their bases, loosely spreading, leafy throughout. Leaves a pleasing green, very numerous, rather loosely arranged, wavy and curled (dry), the free part very narrow linear, ½ inch long, $\frac{1}{30}$th inch broad, tip acute, canaliculate on upper surface, the centre opaque with a stout narrow prominent nerve; margined; margins translucent, cells minute, orbicular, distinct; slightly serrulate, serratures increasing towards apex (almost entire about base), teeth sharp; the vaginant base large, shining, brown, 1 line wide, abruptly dilated quadrate, with a wavy crease at each side at top owing to the sudden expansion; margins of vaginant portion straight, entire; cells oblong and distinct at the upper angles, but longitudinally linear and compact in the main part. Fruit unknown.

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* "Trans. N.Z. Inst.," vol. xviii., p. 225.

Hab. Ash-beds, base of Mount Ruapehu, Tongariro Range, "altitude 5,400 feet," County of East Taupo; 1887: *Mr. H. Hill.*

Obs. I. This fine species is near the large known New Zealand species, *P. dendroides*, Comm., but differs much from that plant in several characters—viz., in the number, size, and disposition of its branches, in its leaves being of a fresh light-green colour, longer, narrower and margined, with fewer, shorter and sharper teeth, and especially in the shape and larger size of their lower vaginant portion; in the stem-leaves being continuous imbricate and closely adpressed, with also large quadrate bases; and in its thick white woolly roots.

II. I have received several good specimens of this plant, and they are all very similar; unfortunately none bear fruit. This, however, is a common feature with those large dendroid mosses, and is often found to be the case with *P. dendroides*, *P. squamosa*, *Dawsonia superba*, etc. I have occasionally fallen in with large patches of these mosses in the forests without detecting a single fruiting specimen. Indeed, both in Schwaegrichen's drawing with dissections of *P. dendroides*, and in Hooker's drawing of *P. squamosa* (discovered by him in Fuegia), there are no fruits given.

Genus 61. **Isothecium**, Bridel.

§ B. HYPNODENDRON.

(Stem naked below, fastigiately branched above.)

a. Capsule terete.

1. *I. heterophyllum*, sp. nov.

Stems stoutish, erect, 3–4 inches high, woody, dark-coloured (blackish-red), shining, scarred below, leafy above, base thickened with many fine dark-brown capillary rootlets; numerously and closely branched at top of stem, sub-umbellate, mostly suborbicular in outline, 2–2½ inches diameter; branches 1½ inches long, 3-pinnate, spreading, sometimes the lowermost pair of branches are very long and depending. Leaves pale-green, shining, sub-concave, of various shapes and sizes; cells narrow, linear, crowded, broader shorter and clearer at bases; margins not bordered: (1) leaves on upper stem large, broadly-ovate-acuminate, 1½ lines long, distant, transparent, spreading, dimidiate, their margins very slightly and distantly denticulate-serrulate; outer basal margin much rounded, subamplexicaul; tips piliferous, flexuous: (2) leaves on branches sexfariously disposed, very close, crowded, imbricate, spreading, of three forms and sizes, (*a*.) broad and similar to those on main stem but shorter, nerve red-brown; (*β*.) ovate; and (*γ*.) narrow-oblong, strongly nerved, nerve not percurrent, vanishing below apex, tip mucronate, upper margins sharply serrate, nerve at back near top serrate sub 6 teeth; the ultimate branchlets red-brown, glossy, with the leaves quadrifariously and more loosely disposed; perichætial leaves very long, subulate, ½ line wide at bases, erect, flexuous; tips piliferous, very slightly and distantly serrulate (*sub lente*), with 5–7 dark longitudinal plaits, red at bases. Fruit-stalks many, sub 20 on a stem on the upper side of main branches, 1–1¼ inches long, red and smooth (as also capsule), very flexuous, drooping, largely vaginant; vagina dark-brown. Capsule cernuous, not grooved, obovate-oblong, cylindric, turgid, unequal, lower edge straight, the upper gibbous; outer teeth incurved when dry, subulate, broad at base, brown, tips pale, closely barred with no medial line, margined with a dark line and a narrow hyaline slightly erose outer margin; inner teeth pale-yellow distantly barred with brown, their tips brown and filiform, with two long capillary knotty ciliæ between each tooth. Operculum half as long as capsule, base hemispherical, acuminate with a long obtuse beak. Calyptra dimidiate, 2 lines long, narrow subulate, obtuse, red, glabrous, glossy, cylindrical and entire for more than half of its length.

Hab. Growing on the ground in large patches among *Hymenophyllum*, in shady forests near Danneverke, County of Waipawa; 1887: *W.C.*

Obs. A fine handsome moss; its affinities are with two or three other fine dendroid New Zealand species of this genus—viz., *I. menziesii*, Hook. f. and Wilson; and *I. kerrii*, Mitten; but differing from the former in its differently-shaped and much shorter capsule, in its perichætial leaves not being serrate, and in its larger piliferous stem-leaves; and from the latter in its nerves not being excurrent; while from *I. marginatum*, Hook. f. and Wilson, it also differs in its capsule not being grooved and its leaves not margined.

2. *I. obscurum*, sp. nov.

Plant densely matted; rhizome creeping, branched. Stems dendroid, erect, 1½–2 inches high, sub-rigid, stoutish, cylindrical, bare and ringed below, with a few distant foliaceous scales scattered above; 3-pinnate, much and irregularly branched; branches at their bases like the main stem; branchlets usually short, stiff. Leaves dull green (becoming brownish and discoloured in age), sub-quadrifariously disposed, erect, very close, compact, imbricate, spreading, all similar, sub-linear-ovate, entire, acute, nerveless; cells very minute, narrow-linear, long, crowded, shorter and clearer at base; perichætial leaves long, acuminate, recurved, extending along fruit-stalk. Fruit-stalk short, 3 lines long, reddish, curved at tip. Capsule oblong, smooth, sub-erect, reddish; operculum sub-conical, with a short obtuse beak. Calyptra (young) smooth subulate long, narrow.

Hab. On ground, woods south of Danneverke, County of Waipawa; 1887: *W.C.*

β. Capsule grooved.

3. *I. tomentosum*, sp. nov.

Plant dendroid; stems stout, erect, flexuous, 2–3 inches high, bearing many large scattered leaves, densely clothed with fine dark-brown branched tomentum-like rootlets, the top much and closely branched forming a thick globose mass 1½ inches wide; branches pinnate. Leaves numerous, rather close, sub-decussate, their bases imbricate, triangular-ovate, base sub-cordate, clasping, very acuminate, tips acute, spreading; margins of upper half coarsely serrated, of the lower half slightly uneven and narrowly margined, pale-yellowish-green (tinged with red in age), glabrous, glossy, nerve stout, vanishing below tip; cells longitudinal, exceedingly narrow, broader and oblong at the wings of base; leaves of stem very large, 2 lines long, 1 line broad at base, triangular, very acuminate: tips acute, long, almost acicular; nerve strong, sub-flexuose. Fruit-stalks numerous, 1–20, erect, 1 inch high, stoutish, flexuous, twisted above, dark-red, shining. Capsule sub-obovate, 1½ lines long, broadly and deeply grooved, dimidiate, horizontal and sub-cernuous, the lower margin straight, the upper arched, strumose, dark-red, glossy; operculum large, nearly as long as capsule and same colour, hemispherical, beak very long, depressed, acute.

Hab. High lands, interior, north of Napier; 1887: *Mr. A. Hamilton.*

Obs. This species has affinity with *I. comosum*, Hook. f. and Wilson, but it is very distinct. Unfortunately I have only had two specimens to examine (the discoverer having mislaid his specimens), and both were old, with the greater number of their capsules broken (or gnawed) at their tips.

Genus 67. **Hypopterygium**, Bridel.

I. HYPOPTERYGIUM.

(Stem 2–3-pinnately branched above, there orbicular or deltoid in outline; branches radiating. Fruit-stalk rather long.

β. Leaves with bristles intermixed.

1. *H. elegantulum*, sp. nov.

Rhizome long, creeping, slender, distantly branched. Plant 1½–2 inches high, erect, bipinnate, soft, delicate, neat, bright emerald-green. Stem slender, usually ½ inch, sometimes 1 inch long, simple (rarely forked, or with 3 main-stem-like branches), scaly from base; scales sub-foliaceous, distant, scattered, sub-ovate-acuminate, patent. Frond orbicular, 1¼–1½ inches diameter; branches few, alternate, open, radiating, very narrow. Leaves (lateral) sub-distichous, distinct, free, alternate, dimidiate, orbicular-ovate, serrate, tip very acuminate, the bases large and overlapping; nerve extending ¾ths of leaf; cells minute, sub-orbicular, guttulate, crowded: (dorsal) deltoid-orbicular, ciliate, nerveless, tip acuminate very long; cells larger and clearer; a single long flexuose spreading seta alternate from each dorsal leaf: (perichætial) outer leaves sub-orbicular, concave; the inner ovate-acuminate, margins entire; tips very long, piliferous, flexuous; cells long linear, very close. Fruit-stalk 3½ lines long, twisted, thickened at top, red-brown, vaginant, 2–12 together on a stem. Capsule cylindrical, oblong, constricted below mouth, tubercled at base, horizontal and inclined, red-brown; cells of capsule broadly oval with double walls and minute cellules in them. Teeth, outer, brown, subulate, very acuminate, tips sub-piliferous, with closely barred double lateral lines and a short faint median line, margins dark; inner teeth, short, pale, blunt, loosely barred. Calyptra (immature) conical-acuminate, slightly fissured at base, not dimidiate; base white, pale-green above. Operculum not seen.

Hab. On the ground, shady ravines, forest south of Danneverke, County of Waipawa; 1887: *W.C.* Rather scarce.

Obs. A species having pretty close affinity with *H. tamariscinum* and *H. rotulatum*, Hedw. Its habit of growth more open and scattered than obtains in the other New Zealand species of this genus. A truly elegant moss.

ORDER V.—HEPATICÆ.

Genus 2. **Jungermannia**, Linn.

1. *J. geminiflora*, sp. nov.

Plant tufted, spreading, erect, 1 inch high, branched; stems very leafy and rooting on under-surface, 1/20th inch wide. Leaves light-green with a purplish tinge, sub-deltoid-ovate, 1/18th inch long, very broad, acute, apiculate, tips incurved, opposite, imbricate, sub-vertical, spreading, narrowly margined with a dark line, edges unequal entire and slightly undulate, mostly more so on one side, decurrent on upper surface; cells minute, orbicular, distinct, guttulate, arranged regularly in longitudinal rows, smaller at margins, larger oval and punctured in centre; involucral leaves large, spreading, waved, deeply laciniate-ciliate. Stipules 0. Perianth terminal, often twin (1 on short lateral branch at tip), large, 1¼ lines long, oblong-ovate, inflated, sub-

3-plicate, mouth deeply laciniate; laciniæ ciliate at tips; ciliæ waved, jointed; cells as in leaves. Capsule (immature, at bottom of perianth) stalked, globular, longer than broad, apiculate, shining, green. Sporules numerous, triangular; elaters small, stout, obtuse.

Hab. In patches among mosses, woods South of Danneverke, County of Waipawa; 1887: *W.C.*

Obs. A species allied to *J. monodon*, Hook. fil. and Tayl., but differing in several particulars.

Genus 3. **Plagiochila**, Nees and Montagne.

§ I. Stems simple or sparingly branched.

1. *P. recta*, sp. nov.

Plant small, gregarious; rhizome creeping. Stems erect, simple, sometimes forked or slightly branched, ¾ – 1 inch high, 2 lines wide, tips decurved. Leaves alternate, sub-imbricate, obliquely oblong-cordate, entire, falcate, very thin and tender, of a lively light-green, apex truncate, recurved, with 2 minute divergent acute teeth, one at each outer angle; ventral margin much arched, the base free, large and round, produced and meeting the opposite leaf on ventral side, and so appearing as a uniform longitudinal line or ridge; dorsal margin straight, decurrent, with a crease in each leaf where it joins the stem. Cells crowded, orbicular with double walls and minute cellules regularly disposed in their centres, clear. Involucral leaves broader and larger with margins minutely denticulate. Perianth large (for plant), terminal, sessile, pale green, sub-oblong-quadrate, sides straight (*poculiform*), thin, much compressed above, inflated below, mouth truncate, entire, margin slightly sinuate and irregularly denticulate.

Hab. In low wet woods near Norsewood, County of Waipawa; forming small thick patches on branches of trees; 1886: *W.C.*

Obs. This is a peculiar looking little species when in flower, owing to its large pale and straight-sided terminal perianths; apparently it is rather scarce. In size and general appearance it is somewhat like *P. serrata*, Lind., and *P. approximata*, Lind.; while the form of its leaves closely resembles those of *P. radiculosa*, Mitten, (a much larger indigenous species, differing widely in habit, shape of perianth, and areolation;) its leaves are also largely and regularly produced at their ventral bases, somewhat like those of *P. hypnoides*, Lind.

2. *P. cæspitosa*, sp. nov.

Plant densely gregarious; rhizome creeping, wiry, dry, much branched and implexed. Stems brownish, erect, simple, rarely branched, 1 – 1½ inches high, 3½ lines wide, leafy to base, tips recurved. Leaves alternate, close, sub-imbricate, obliquely cordate-orbicular, 2 lines long, very obtuse, narrowly margined, semi-amplexicaul, spreading, decurved, dusky pale-green rather obscure (when dry, margins revolute); ventral margin and apex denticulate, teeth irregular and distant, acute and obtuse, base free, produced, overlapping stem; dorsal margin entire, nearly straight, slightly decurrent, thickened and contracted at junction with stem, small and sub-orbicular at base. Cells very small, oval, with double walls and minute cellules in them, crowded, distinct. *Male:* Spike near top of branch, broadly conical, 5-jugate; scales rather large, entire, recurved; sometimes 3 – 4 spikes on one branch, each separated by a few leaves. Fruit not seen.

Hab. Forming small thick cushion-like tufts on branches of trees, in low, wet, and dark woods, "Forty-mile Bush," near Norsewood, County of Waipawa; October 1886: *W.C.*

3. *P. heterophylla*, sp. nov.

Plant small; rhizome wiry, creeping; stems erect, sub-rigid, 1½ inches high, 2 lines broad, distant, simple and forked, leafy to base, reddish-brown; branches few, long and straight, with a few short branchlets at top, pale reddish-green and semi-transparent. Leaves bright-green sub-amplexicaul, slightly decurrent both sides on stem, the ventral bases scarcely overlapping; those on main stems triangular or deltoid-oblong, their apices very obtuse, 12 – 14 irregular long laciniate teeth on ventral margin and at apex, of which about 6 are apical; leaves on the branches $\frac{1}{10}$th inch wide including stem, with fewer teeth; and those on the ultimate branchlets are exceedingly small, being only with the stem $\frac{1}{20}$th inch wide, oblong, the ventral margin rounded, the dorsal straight, and both entire; the apex truncate with 2 – 3 very long and distant spiny teeth. Involucral narrow, erect, with 3 – 4 long spreading laciniæ at apex. Cells minute, sub-orbicular, crowded, walls thick with numerous minute intermediate cellules. Perianth small, terminal and solitary at end of stems and main branches, peduncled, narrow-campanulate, $\frac{1}{10}$th inch long, whitish; base tapering, constricted; mouth broad cilio-laciniate; teeth many, erect. Capsule sub-obovoid, brown; valves oblong-lanceolate, obtuse, dark-veined longitudinally; seta exserted, 2 lines long.

Hab. On logs and trunks of trees, wet woods near Dannevirke, County of Waipawa; 1887: *W.C.*

Obs. This is a small delicate-looking slender wiry species, allied to *P. distans*, Col.,* and *P. distinctifolia*, Lind. Its small leaves resemble those of *P. spinulosa*, Nees and Mont., a British species.

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* "Trans. N.Z. Inst.," vol. xix., p. 288.

4. *P. rotundifolia*, sp. nov.

Plant densely cæspitose, sub-dendroid, erect, 1 inch high, dark olive-green, the young leaves at tips light-green; stem bare at base, forked, loosely branched above in 4–5 branchlets; tips recurved, drooping. Leaves small, close, imbricate, spreading, rotund, $\frac{1}{15}$th inch diameter, undulate, slightly decurrent, sub-amplexicaul, the portion adhering to stem being very small, margins minutely and regularly waved and finely serrulate (*sub lente*); dorsal margin recurved, entire near stem. Cells minute, orbicular, with thickened walls and very minute cellules in them, larger and oblong at base of leaf.

Hab. Among small herbage, shaded woods, base of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

§ II. Stems erect from a creeping rhizome, tall, much branched, dendroid.

5. *P. trispicata*, sp. nov.

Rhizome creeping, matted; plant densely cæspitose; dendroid, erect, 4–4½ inches high, main stem 1½–2 inches long, leafy from base, 3 lines wide, much branched at top; branches 1½–2 inches long, 2–2½ lines broad, spreading, erect, dichotomous, branches and leaves flat. Leaves yellowish-green tinged with brown, alternate, imbricate; those on the main branches broadly sub-deltoid, 2 lines long (smaller on the branchlets); ventral margin curved, laciniate-toothed, the bases round and much produced, largely cilio-laciniate and overlapping; dorsal margin straight, nearly entire or with 1–2 small teeth, and set very obliquely on stem; apices truncate with 3–5 large irregular sub-laciniate teeth. Involucral leaves much the same, but erect, with their dorsal margin more ciliated. Cells broadly oval, distinct, filled with minute pellucid cellules. Perianth terminal on short lateral branchlets, sessile, compressed, whitish, 2¼ lines long, ovate, dimidiate, obtuse; mouth sub-urceolate; lips and apex largely laciniate-ciliate; laciniæ bifid, acute, sub-flexuous, spreading, cellular. *Male* plant smaller and less robust; spikes terminal at tips of branches, mostly 3 (sometimes 2, 4,) together, shortly peduncled, 2 lines long, divergent, sub-triangular, acute, deeply channelled on one side; scales in 2 rows, large; tips recurved, the lower nearly entire, the upper shortly bidentate.

Hab. On trees and logs, damp woods near Danneverke. County of Waipawa; 1887: *W.C.*

Obs. A rather peculiar species from the shape of its perianth, and also from its conspicuous and divergent 3 male spikes.

6. *P. axillaris*, sp. nov.

Plant closely cæspitose, pale green; rhizome wiry, creeping, much entangled, tough. Stems erect, leafy from base, 2–3 inches high, 8 lines wide, simple, forked at middle, branched at top into 4–5 short branchlets; tips recurved. Leaves alternate, rather distant, not imbricate, broadly oblong or somewhat suborbicular, wavy and concave, 2 lines long, apex much rounded; the ventral margin and apex distantly and irregularly cilio-laciniate; the dorsal margin entire, base slightly oblique and decurrent on stem. Cells orbicular, crowded, smaller at margins, their walls double, thickened, with minute cellules. Perianths few, scattered, axillary between branches, sessile, obconic-campanulate, 1 line long, compressed; apex rounded; lips ciliated, extending down on one side; dark-green.

Hab. On trees and logs, in woods with the preceding species, *P. trispicata*; 1887: *W.C.*

7. *P. subfasciculata*, sp. nov.

Plant dendroid, 2–8 inches high; rhizome creeping, long, wiry; stems slender, erect, sub-rigid, dark coloured, leafy from base, much branched; branches alternate, bipinnate, long, diffused, irregular, (often a long branch at right angles from main stem,) branchlets opposite, sometimes 4 – 6 short ones nearly together at top of branch, sub-fasciculate. Leaves light-green, sub-opposite, rather distant, scarcely overlapping at extreme margins, somewhat semi-lunar or sub-rhomboid-dimidiate, apex broad, rounded; those on main stems and branches 2 lines wide, on branchlets much smaller; ventral margin much curved and, with apex, laciniate toothed, sub 12 teeth, long, acute, irregular in size, distant, longer and closer at apex, few or none at base, basal margins slightly impinging, decurrent on stem, sinus between teeth broad and rounded; dorsal margin entire, oblique, slightly decurrent on stem. Involucral large, erect, apex much laciniate. Cells opaque, sub-orbicular, double-walled with minute intermediate cellules. Perianth rather small, dark-green, sessile, axillary between branchlets, broadly cuneate or sub-campanulate, slightly compressed; mouth large; lips rounded, cilio-laciniate; teeth irregular, larger in centre, acute, many-celled. Cells similar to those of leaves but more oblong.

Hab. On logs and trunks of trees, wet woods near Danneverke, County of Waipawa; 1887: *W.C.*

Obs. The nearest affinity of this species is with *P. exilis*, Col.*

Genus 7. **Gottschea**, Nees.

* Leaves stipulate.

1. *G. truncatula*, sp. nov.

Plant small, gregarious, prostrate, ⅓ – ¾ inch long, 4 lines wide, oblong, simple rarely forked, dark-green, leafy from base, with numerous dark-purple rootlets. Leaves close, imbricate, very thin; ventral lobe oblong-ovate, tips rounded with 2-4 narrow plaits running obliquely from dorsal lobe to margin; margins minutely serrulate and irregularly sinuous and notched from the plaits; the upper basal margin largely ciliate; ciliæ capillary, long and wavy, composed of several single cells placed longitudinally: the dorsal lobe short, only ⅔rds length of the ventral, sub-trapeziform or sub-cordate-dimidiate, minutely serrulate, its upper basal margin rounded and produced beyond the ventral lobe but not really wider than it; apex broad and very truncate. Cells sub-orbicular, close, with double walls containing minute pellucid circular cellules. Stipules large, somewhat sub-quadrate in outline, narrowest at base, 3-4-lobed, much laciniate and largely ciliate; ciliæ long, jointed, very flexuous and acute; cells narrow-oblong, their ends obtuse and truncate, closely compacted. On the stem between the leaves are several long narrow irregular cellular processes or leaflets, in 2-3 rows, patent and much ciliated.

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* "Trans. N.Z. Inst.," vol. xix., p. 282.

Hab. On the ground, in damp woods near Danneverke, County of Waipawa; 1887: *W.C.*

Obs. A species near *G. trichotoma*, Col.,* but differing in being much smaller and simple, with notched margins to its leaves, and particularly in its very short and broadly truncate dorsal lobe.

2. *G. flavo-virens*, sp. nov.

Plant very small, gregarious, prostrate, broadly obovate, sub ½ inch long, simple; yellowish-green with red rootlets at base. Leaves oblong-ovate, obtuse, margins slightly serrate; the ventral basal portion shortly laciniate-serrate; the margin of the dorsal lobe very slightly serrulate, tip oblique, rounded, the base slightly produced, its margin nearly entire. Stipule large, sub-quadrate, bilobed; lobes broad, coarsely laciniate with numerous broad laciniæ; sinus large, extending ⅓rd down. Cells small, orbicular and very regular, with minute pellucid cellules in angles between cells; oblong and larger at base of stipule.

Hab. On the ground, sides of streams, in woods with the preceding species, *G. truncatula*; 1887: *W.C.*

Obs. A species having affinity with *G. pallescens*, Col., and *G. læte-virens*, Col.†

3. *G. squarrosa*, sp. nov.

Plant large, sub-ascending, 7 inches long. Stem stout, dark-brown, leafy, simple, with 2-4 short and forked branchlets at top; base bare. Leaves alternate, large, green, very distant

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* "Trans. N.Z. Inst.," vol. xviii., p. 240.

† "Trans. N.Z. Inst.," vol. xviii., pp. 238 and 241.

and squarrose on main stem, which is 5 – 6 lines wide including leaves, decreasing in size downwards towards base, close and sub-imbricate on branches, conduplicate, lobes united at lower dorsal margin, which is thickened and entire; dorsal lobe oblique, cordate-acuminate, the base very much produced and rounded semi-orbicular, margin entire; tip suddenly acuminate, acute; anterior margin uneven, wavy with minute plaits, both upper margins and tip finely denticulate; ventral lobe much longer than dorsal, sub-oblong-trapeziform, apex oblique, obtuse, the anterior margin nearly straight; margins minutely serrulate with a few (2 – 3) small ciliæ near base; the apices of the two lobes very divergent. Stipules distant from base of leaves, patent, large, rotund, 1½ lines diameter, retuse; margins entire, slightly and sparingly ciliate at apex and on the upper sides; finely and obsoletely waved laterally, with a long thick longitudinal plait in the centre. Cells rather opaque, crowded, oval; walls thick with minute cellules in the angles. 2 – 3 small linear segments (phyllodia) on main stem in the axils of the leaves, their margins entire with 2 long hair-like ciliæ at the tip of each.

Hab. High lands, woods north of Napier, Hawke's Bay; 1886: *Mr. A. Hamilton.*

Obs. This is another very fine species, pretty closely allied to *G. nobilis*, Nees, and to *G. dichotoma*, Col.,[*] but differing considerably in many characters: as in the great distance between the stem leaves, and their squarrose habit, in the form and serratures of leaves, lobes, stipules, and phyllodia, and in their cells.

** Leaves without stipules.

4. *G. plumulosa*, sp. nov.

Plant densely tufted, erect, 1½ inches high; yellowish-green, becoming light-brown in age; stems stout, 3 lines wide including leaves, sub-obovate-linear, leafy to base, simple and forked, sometimes with two short opposite lateral branchlets at tips; tips nodding, sub-circinnate. Leaves exceedingly thin, very close-set, bifarious, regular, imbricate, spreading, their lobes conduplicate united at the dorsal margin, the dorsal lobe a little smaller, both lobes overlapping at dorsal and ventral bases, deeply bifid at apex; apical segments long, laciniate, acuminate; margins of both lobes largely laciniate-ciliate; ciliæ very long, 2 – 3 branched, acute, and very cellular. Stipules 0. Cells large, very distinct, oval; their thickish double walls containing numerous minute cellules.

Hab. Forests, Ruatahuna, County of Whakatane; 1886 *Mr. A. Hamilton.*

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[*] "Trans. N.Z. Inst.," vol. xviii., p. 234.

Obs. This species is allied to *G. pinnatifolia*, Nees; and also to *G. ciliigera*, Hook. f. and Taylor, another large species; but it is a much smaller plant than either, and widely differing in habit, and the form of its compound laciniate ciliæ and cells. Sir J. D. Hooker has united those two species in the "Handbook N.Z. Flora," p. 514, but I venture to consider them to be very distinct. This small species is a truly elegant plant, and takes its trivial name from its nodding plume-like tips.

5. *G. homophylla*, sp. nov.

Plant small, prostrate on mosses, and sub-ascending. Stems ¾–1 inch long, simple and forked near base, ovate-acuminate and broadly lanceolate, 4 lines wide, leafy throughout, with a few fine rootlets at base; both sides of the plant nearly alike; colour a pale whitish-brown (which may, however, have happened from being badly dried). Leaves closely imbricate, sub-falcate, excessively thin, broadly ovate; both dorsal and ventral lobes sub-similar in shape, ovate-acuminate, the ventral a little more acuminate; margins entire; tips serrate; dorsal lobe concave, united to ventral lobe within margin, which extends in a narrow line beyond it; the stem completely hidden on both upper and under sides through the leaves closely and largely overlapping. Stipules 0. Cells small, sub-orbicular and somewhat obscure, with minute starry dots at their angles.

Hab. Forests near Waikare Lake, County of Whakatane; 1886: *Mr. A. Hamilton.*

Obs. This is a most peculiar and very distinct species, widely differing from all others known to me. Its upper and under surfaces are so very much alike that it is difficult to distinguish them, save by their rootlets at their bases; there are also its entire margins, and it being without stipules; and then the most curious structure of its cellules and their unique star-like appendages. Unfortunately, I have seen but a few whole specimens (about half-a-dozen); it seems to have been collected hastily among other and larger *Hepaticæ* and mosses, whence I picked it out.

Genus 16. **Isotachis**, Mitten.

1. *I. rosacea*, sp. nov.

Plant closely gregarious, erect, delicate. Stem rather stout, dark-coloured, 8 inches high, narrow, 1 line wide including leaves, leafy throughout, 1–2 branches above; branches ½–1½ inches long, spreading; tips rounded, nodding. Leaves very close, uniform and regular, sub-opposite on main stem, and opposite on branches, all rose-pink, (also the stipules,) sub-quadrate, apices quadrifid; lobes free, sinuses large, coarsely denticulate; tips acute; dorsal margin entire; ventral margin denticulate; sub-imbricate and closely adpressed at their dorsal bases completely hiding the stem; their ventral bases patent. Stipules patent, cordate, bifid; apices obtuse; margins sub-ciliate-denticulate; ciliæ free, rather distant; bases sub-amplexicaul. Cells oval and sub-orbicular, smaller at margins, larger oblong and parallelogrammatic in the centre and at the

Hab. High lands, interior, north of Napier; 1886: *Mr. A. Hamilton.*

Obs. A truly graceful species; pretty nearly allied to *I. lyallii*,* Hook. fil., but differing in size, colour, shape of leaves and stipules, and in the form, etc., of its cellules. Its delicate rose-pink colour, alike throughout, enhances its beauty, and makes it an attractive and elegant object.

Genus 17. **Trichocolea**, Nees.

1. *T. elegans*, sp. nov.

Plant prostrate, spreading in thick matted tufts or patches, with rather long creeping stems or ultimate branches (2–8 inches), bright green, sub-quadri-pinnate. Stems minutely and closely hairy, their leaves broadly transverse rather distant; secondary branches bipinnate, horizontal, broadly ovate or rhomboid in outline, presenting a regular fern-like appearance; branches and branchlets cylindrical, symmetrical, radiating, spreading; ultimate branchlets compacted, sub-globose, and pale at tips. Leaves numerous, sub-verticillate; segments wholly capillary, branched, jointed, acute, implexed. Stipules multifid, capillary spreading, much like leaves. Peduncle very stout, 1 line long, succulent, slightly hairy, erect from upper surface of branches near top of frond, sometimes geminate. Calyptra oblong, scaly, very hairy at top, hairs whitish, spreading; scales long, ovate-acuminate, laciniate-ciliate, recurved.

Hab. On rotten logs, wet shaded woods, Norsewood, County of Waipawa; 1886; and also near Dannevirke, same county; May, 1887; *W.C.* Glenross, County of Hawke's Bay; October, 1887: *Mr. D. P. Balfour.*

Obs. This is a truly elegant little plant; its pleasing green tufts, with their central short flat bipinnate radiating branchlets symmetrically disposed, give it a very neat appearance; which is still further heightened by its long slender creeping stems or branches. While in shape and habit it differs largely from its congeners, *T. tomentella* and *T. lanata*, yet it approaches them pretty nearly in the form of its leaves and stipules; which, however, are still more multifid and capillary.

*** Originally discovered on the summits of the neighbouring high mountain (Ruahine) range.**

Genus 23. **Frullania**, Raddi.

1. *F. viridis*, sp. nov.

Plant creeping, 1 – 2½ inches long, bipinnate, green; branches numerous, rather long, free, spreading, somewhat soft. Leaves imbricate and closely set, rotund-reniform, patent; margins entire and slightly irregular; lobule minute, arched, green; tip sub-acute. Stipules adpressed, reniform-orbicular; margins slightly uneven, shortly bifid, sinus cuneate, broad. Cells minute, orbicular, opaque, larger at bases. Perianth smooth, oblong, sub-inflated, triquetrous, largely obtusely angled on one side, with a corresponding central depression on the other; apex obtuse, mucronulate.

Hab. On branches of trees, forming thickish patches, forests at Danneverke, County of Waipawa; 1887: *W.C.*

Obs. A species allied to *F. squarrosula*, Hook. f., but of a different habit, form, and colour, with differently shaped leaves and stipules, and the perianth more inflated and keeled.

2. *F. echinella*, sp. nov.

Plant small, purple-brown, sub-rigid, creeping, 1–2 inches long; stems closely intermixed and overlapping; branches dichotomous, leafy, narrow, $\frac{1}{50}$th inch wide including leaves; branchlets pinnate. Leaves alternate, imbricate, broadly oval, their tips sub-recurved; young leaves green, brownish on upper surface with narrow dark margins; lobule small, not produced beyond leaf, arched with acute tip; corner of leaf not inflexed. Cells regular, orbicular, with a minute pellucid round cellule in each outer angle. Stipules sub-orbicular, longer than broad, margins slightly uneven, bifid nearly to base, angles of lobes acute. Perianth sub-obovate, triquetrous, sub-compressed, one side slightly convex, the other carinate, finely and densely muricate-echinulate; apex retuse, mucronate. Involucral leaves margins entire.

Hab. On branches of living trees, chiefly *Myrtus bullata*, forming tolerably large and thick patches; sides of streams, forests near Danneverke, County of Waipawa: 1887: *W.C.*

Obs. This species, from its peculiar perianth, will no doubt belong to the new sub-genus *Trachicolea*[*] of Dr. Spruce; one of the smallest sections of this very large and extensive genus.

Genus 24. **Fossombronia**, Raddi.

1. *F. gregaria*, sp. nov.

Plant densely cæspitose, erect, 2 inches high, succulent, fragile, pale green. Stems simple, rarely forked, with many purple rootlets. Leaves large, 3½–4 lines broad, imbricate, pellucid, waved and crumpled, semi-amplexicaul, margins sinuate; the upper leaves sub-reniform, sub-rosulate at top of stem; the lower, sub-quadrate and largely decurrent. Cells very large, of various shapes and sizes, broadly hexangular, oblong, sub-quadrangular and sub-orbicular. Perianth terminal and sub-terminal, broadly campanulate, 2¼ lines long, 2 lines broad, mouth open, spreading, much waved, margin sinuate, entire; colour and cells as in leaves. Seta 9–15 lines long, erect, stoutish, white. Capsule oblong, very obtuse, minutely reticulate, dark-brown; valves 4, split to base, but breaking up into quadrangular bits after the manner of *Petalophyllum*. Elaters brown, cylindrical, flexuous, bi-spiral, forming an unbroken curve or loop at one end, and returning, so that the two ends equally meet at the opposite end; tips truncate. Spores orbicular, echinulate.

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[*] In his "Hepaticæ Amazonicæ et Andinæ," p. 81. An excellent and exhaustive work of nearly 600 closely printed pages, reflecting the highest credit on the author, also on the Botanical Society of Edinburgh, under whose auspices it was recently published.

Hab. Woods at Tarawera, hilly country north of Napier; 1886: *Mr. H. Hill.*

Obs. A very peculiar species, from its erect and densely gregarious habit of growth, so different from that of its known congeners. In determining the curious elaters of this species I have been generously and largely aided by Dr. W. I. Spencer. F.L.S.

Genus 27. **Zoopsis**, Hook. f. and Tayl.

1. *Z. tenuicaulis*, sp. nov.

Plant minute almost capillary, straight and flexuous, pale green; frond prostrate, delicate, highly cellular, transparent, few-branched, 1–1½ inches long, $\frac{1}{40}$th inch broad; midrib strong and dark, a single row of large sub-oblong-quadrate cells on each side, with 2 fascicled claw- (or finger-and-thumb-) like lobes, alternately and pretty regularly disposed on both sides, the upper lobe of 3 (rarely 4, 5,) cells always the longest and sub-acute, the lower lobe of 2 (rarely 3) cells stouter and obtuse; the cells of the lobes oblong-orbicular, the lowest one being much larger, the upper (of the 3-celled lobe) very small and curved; the lobes on the lower part of the stem distant, those on the upper portion and on the branchlets are much closer. Flowers and fruit not seen.

Hab. Among *Symphyogyna*, and other low close-growing *Hepaticæ*, from base of Tongariro Mountain Range, County of East Taupo; 1887: *Mr. H. Hill.*

Obs. A very minute microscopical plant, picked out from among other *Hepaticæ;* allied to *Z. argentea*, Hook. f. and Tayl., but much more slender and very distinct.

2. (?) *Z. ciliata*, sp. nov.

Plant small, tufted, delicate, flaccid, erect, ½–¾ inch high, bright grass-green. Fronds flat, a little waved, $\frac{1}{10}$–⅛ inch broad at base, simple, lobed, and digitate above; lobes long, linear, $\frac{1}{40}$ – $\frac{1}{30}$ inch wide, sometimes forked and trifid, obtuse and sub-acute; margins slightly sub-sinuate and denticulate, ciliate with scattered long brown glandular flexuous flattish ciliæ; the bases of fronds red-brown and hairy; hairs long and flexuous. Cells large, irregular, of various sizes and shapes, mostly oblong-hexagonal, smaller, regular, and sub-quadrangular at margins; minute, obovate and lanceolate, obtuse, sub-sessile lobes (or sacs?) are sometimes scattered (occasionally 2 – 3 together) on margins and disk of frond, also at apex, giving it a proliferous appearance; their cells are smaller and orbicular.

Hab. Among other densely-growing *Hepaticæ*, on branches of living trees, woods near Norsewood, County of Waipawa; October, 1886: *W.C.*

Obs. This is a curious and strange-looking little plant; to me, almost unique in appearance, etc.; its fructification, however, has not yet been detected, and therefore it is only now placed provisionally here as a species of *Zoopsis.* To this small endemic genus of frondose *Hepaticæ* it seems to be more naturally allied than to any other; at the same time there are grave differences. I may also observe that I have only now met with this plant, in this one locality, though pretty plentiful there.

Genus 30. **Symphyogyna,** Mont. and Nees.

1. *S. connivens,* sp. nov.

Plant terrestrial, small, simple, gregarious, stipitate, erect; delicate pale-green; root (and stipe) dark pink, cylindrical, succulent, slightly hairy; hairs patent; stipe $\frac{3}{4}$ inch long, flexuous, smooth, glossy, succulent; frond oblate-orbicular, broader than long, 6–8 lines broad, 4–5 lines long, dichotomous, 2-branched from top of stipe; branches equal, broad at bases, conniving and forming a cup-like cavity at top of stipe, wavy, not decurrent, on stipe; each branch 2 – 3-lobed or sub-branched, and cut nearly to base; each lobe deeply divided; ultimate lobes short, broad, truncate, nerved; margins largely serrate; serratures broad, long, and sharp, with 5–9 cells in each; cells large, sub-orbicular, their walls thick and dark. Involucre very small at bases of main branches on the upper surface, 2 on a frond, much and finely laciniate; laciniæ recurved, somewhat glossy. Calyptra (immature) shortly peduncled.

Hab. Among mosses and other small plants, base of Mount Tongariro, County of East Taupo; 1887: *Mr. H. Hill.*

Art. XXX.—*Botanical Notes.*

By J. Buchanan, F.L.S.

[*Read before the Wellington Philosophical Society, 18th February,* 1888.]

Plates XII. and XIII.

Melicope parvula, n. s.

A small glabrous shrub, 5–6 feet high. Branches very slender. Leaves opposite, in distant pairs, ⅙ inch long, obovate, and obscurely crenate; peduncles ⅒th inch long. Flowers in minute clusters, in the axils of the leaves.

This is a distinct though diminutive species of the genus *Melicope*, and its having been found growing along with the larger species of that genus points to the probability of this new plant being the natural result of the altered conditions of one seed, and not through a long derivative process of ancestry.

The species of *Melicope* in New Zealand are remarkable as presenting a gradually diminishing size, from the largest-leaved species, *M. ternata*, to the present minute species, *M. parvula*, which barely leaves room for one smaller. Near Dunedin.

Ranunculus tenuis, n. s. Plate XII.

A tall, slender, glabrous plant, 10–12 inches high. Rootstalk ¼-inch diameter. Leaves all radical, ovate-oblong in outline, tripinnatisect, segments linear or ovate, primary divisions in two opposite pairs. Scape slender, 6–10 inches long, leafless. Flower 1¼ inch diameter, white or pale yellow. Petals 5–10, obovate or linear-obovate; achenes in globose heads; styles black, subulate.

East Taieri Hills, Otago; and Masterton, Wellington.

This species is probably common, but escapes observation from its resemblance to other species.

Notothlaspi hookeri, n. s. Plate XIII.

A small glabrous plant, with numerous flowering branches, which spring from the centre of a group of leaves. Root stout, fusiform. Branches 4–5 inches long, very narrow. Leaves sessile on the ground, densely crowded in the form of a rosette, linear-oblong, crenate near the tips. Leaves of the flowering branches small, ⅓ inch long, linear, acute. Pods ⅓ inch long, very narrow.

Mountains near Lake Wanaka and Lake Ohau.

This beautiful plant is rare, and the accompanying sketch is taken from an indifferent specimen.

III.—GEOLOGY.

Art. XXXI.—*On some Railway Cuttings in the Weka Pass.*

By Professor F. W. Hutton, F.G.S.

[Read before the Philosophical Institute of Canterbury, 5th May, 1887.]

Plate XIV.

In the construction of the railway through Weka Pass, several excellent sections have been made in the younger beds between Waipara and the railway viaduct over Weka Creek. These I examined on the 18th of November last, and the observations I made are, I think, of sufficient interest for publication.

Rocks exposed.

5. After leaving the river gravels of the Waipara the first cuttings on entering the pass show a series of horizontal beds of silt and fine gravel; but without any fossils that I could see.

4. A little beyond the 42nd mile-stone from Christchurch we come to a series of marine sandstones and fossiliferous conglomerates, dipping 12° S.E. by E. The junction between these beds and the horizontal gravels is not exposed, but no doubt the two are unconformable. This marine series is as follows:—

	Feet.
15. Yellow-brown sands with calcareous layers (about)	175
14. Conglomerates and brown sandstones ...	70
13. Limestone and sandstone interbedded ...	15
12. Conglomerates and brown sandstones ...	40
11. Sandy clays and sandstones	20
10. Shell-beds and brown sandstones... ...	50
Total (about)	370 feet.

This brings us to a gully in which stands the 43rd mile-stone from Christchurch, and the next cutting to the north shows the following section (Pl. XIV., fig. 1), where a fault brings a brown sandstone against a series of sandy conglomerates with comminuted shells, dipping 15° S.E. by E. The fault runs about east and west, and does not appear to be of any great importance.

3. Unfortunately another gully follows, and the next cutting shows the following rocks, dipping 20° E.S.E.:—

	Feet.
9. Brown sandstone	10
8. Rust-coloured rubbly limestone with beds of sand and broken shells	18
7. Brown sandstone	25

A gully now follows, and the section is continued in the next cutting as follows:—

	Feet.
6. Sandy clay	?
5. Rust-coloured rubbly calcareous sandstone ...	20
4. Soft brown sandstone	15
3. Rust-coloured sandy limestone with beds of sandstone	80
2. Soft brown sandstone with calcareous bands	50
1. Rust-coloured sandy limestone and sandstone, the sandstones increasing in importance upwards	25

These rusty limestones, from 8 to 1, form what are known as the Mount Brown beds, the total thickness of which is here between 200 and 250 feet. Those beds rest unconformably on laminated argillaceous sandstones with grey calcareous bands, which get more numerous downwards. Very fortunately, this is well seen in the section a little south of the Weka Pass Hotel, and also a little south of the 44th milestone from Christchurch. (Plate XIV., *fig.* 2.)

The rocks on both sides the plane of discordance dip 20° E.S.E., while the plane of discordance itself dips, roughly, 80° in about the same direction, but is irregular. At first sight it might be thought that this plane of discordance was a fault; but the low *hade*, the uneven surface, and the absence of any friction breccia, show, I think, that such is not the case. It seems to me that the older series was horizontal when the newer series was deposited on its denuded edges, and that both have been tilted since.

Dr. Hector has always maintained that the Mount Brown beds rested unconformably on the lower rocks in the Waipara District,* while I have held the contrary view. I now gladly acknowledge that I have been wrong, and that the Mount Brown beds must be separated from the underlying series.

2. These underlying rocks in the Weka Pass are as follows:—

5. Laminated argillaceous sandstones with grey calcareous bands, which get more numerous downwards.
4. Blue sandy marl and sandstones.

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* See Hector, "Prog. Rep. Geol. Surv., 1868-9," p. 12: also Sir J. von Haast, "Reports, Geological Explorations, 1870-71," p. 14.

3. Dark-grey sandy marl, interstratified with grey sandy limestone.
2. Grey sandy limestone passing gradually into
1. Weka Pass stone.

We here reach the 45th milestone from Christchurch, about three-quarters of a mile south of the railway viaduct. Beyond this the Weka Pass stone forms the cuttings up to the viaduct; but at the bottom of the one furthest north the Amuri limestone shows for a short distance. This appearance of the Amuri limestone above its ordinary level is by a fault, represented in my section of the Weka Pass made in February, 1873,* the fault coinciding in position with the railway viaduct.

The beds 3 to 5 constitute the "grey marl" of Dr. Hector, and I estimate their combined thickness to be about 500 feet. Unquestionably they are conformable to the Weka Pass stone.

1. That the Weka Pass stone rests unconformably on the Amuri limestone I have elsewhere tried to prove†, and this has, I consider, been completely confirmed by my survey of the Trelissick Basin last year,‡ where a distinct unconformity is acknowledged to exist above the lower limestone; which limestone, I have shown, agrees in stratigraphical position as well as in lithological composition with the Amuri limestone.

The rocks immediately below the Amuri limestone in the Weka Pass are not seen along the railway line; but the most northerly cuttings in the pass show—

4. Dark greensands.
3. Dark-grey, micaceous, sandy clay.
2. Calcareous green sandstone with sharks' teeth.
1. Bright green argillaceous sands.

CORRELATION OF THE BEDS.

We have, therefore, in the Weka Pass five different series:—

1. The lowest contains the Amuri limestone and the underlying green sandstones, the correlations of which with the saurian beds in the Upper Waipara are not doubted.

2. Next above is the series comprising the Weka Pass stone, and the overlying grey marls and sandstones. I have elsewhere given a list of fossils from this series,§ and have shown that they agree with those from the Curiosity Shop, the Ototara building stone, and the limestones of Maerewhenua and Waihao. Since that paper was written I have been informed by Mr. J. D. Enys

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* "Reports, Geological Exploration, 1873-74," p. 45, sect. 10.

† "Quar. Jour. Geol. Soc. of London," vol. xli., p. 266.

‡ "Trans. N.Z. Inst.," vol. xix., p. 392.

§ "Quart. Jour. Geol. Soc. of London," vol xli., p. 554.

that bones of *Kekenodon* have been found in the Weka Pass stone, near the caves behind the Waikari railway-station, a discovery which strongly confirms the correctness of my opinion. I can also now add that the limestone of Castle Hill, in the Trelissick Basin, is of the same age. In the Canterbury Museum there are some remains of a large bony fish from the Weka Pass stone. They are caudal vertebræ, and look to me much like those of *Histiophorus* (sword-fish).

This series forms the upper part of Dr. Hector's Cretaceo-tertiary formation, and he considers it to be not younger than Lower Eocene. His reasons for this opinion appear to be: (1.) The series is stratigraphically associated with rocks of cretaceous age; (2.) It contains many fossils in common with the cretaceous rocks; (3.) It contains no recent species of Mollusca; And (4.) decidedly mesozoic forms, such as *Belemnites superstes*, are found in it.* On these I would remark: (1.) The series is often found quite unassociated with cretaceous rocks—*e.g.*, Waikato, Golden Bay, Oamaru, Winton;† a stratigraphical break between it and the cretaceous rocks has been proved in Trelissick Basin. (2.) No list has ever been published of the fossils that are said to be "common throughout the formation," and, of course, Dr. Hector cannot expect other geologists to attach much weight to a statement which is not supported by any evidence. (3.) This is not quite correct, for *Voluta elongata*, Swainson, and *Waldheimia lenticularis*, Deshayes, are both found in the Weka Pass stone; and Dr. Hector himself, in the list of fossils sent to the Indian and Colonial Exhibition, mentions six recent species of Mollusca from his Cretaceo-tertiary formation ("Catalogue," pp. 12–14) out of thirty-four species which are named. (4.) The Belemnite is said by Dr. Hector to come from "the black marls under the chalk with flints in the Coverham or Middle Clarence Valley Section"—that is, from *below* the Amuri limestone, and not from the upper beds, which appear to be absent in the Clarence Valley.

With regard to the correlations of this series with rocks in other parts of the world, it must be remembered that it contains *Kekenodon*, *Palæeudyptes*, *Carcharodon angustidens*, and *Aturia ziczac*. Undoubtedly it is the equivalent of the rocks at Bird-rock Point, Portland Bay, Aldinga Bay, Mount Gambier, and the banks of the Murray in Victoria and South Australia; and these rocks are considered to be Oligocene or even Miocene.

3. *Mount Brown beds.*—Fossils in these beds are not very numerous, or, at any rate, have not yet been catalogued, and the following list is taken from Sir J. von Haast's "Geology

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* "Indian and Colonial Exhibition, Catalogue and Guide to the Geological Exhibits," p. 55.

† See "Quar. Jour. Geol. Soc. of London," vol. xli., p. 275.

of Canterbury and Westland," pp. 306 and 311. I have, however, brought the nomenclature up to date:—

1. *Pleurotoma latescens*, Hutton.
2. *Natica gibbosa*, Hutton.
3. *Natica ovata*, Hutton.
4. *Turritella gigantea*, Hutton.
5. *Turritella ambulacrum*, Sowb.
6. *Scalaria lyrata*, Zittel.
7. *Dentalium giganteum*, Sowb.
8. *Cardium patulum*, Hutton.
9. *Cardita difficilis*, Desh.
10. *Cucullæa alta*, Sowb.
11. *Pecten hochstetteri*, Zittel.
12. *Pecten hutchinsoni*, Hutton.
13. *Waldheimia lenticularis*, Desh.
14. *Waldheimia triangularis*, Hutton.
15. *Waldheimia* (?) *concentrica*, Hutton.
16. *Cellepora nummularia*, Busk.
17. *Fasciculipora ramosa*, Busk.
18. *Caratomus* (?) *nuperus*, Hutton.

Of these eighteen species, ten give no evidence as to the position of the Mount Brown beds, being either confined to it or else found equally commonly in both the Oamaru and Pareora Systems. Of the remaining eight species, none are exclusively Oamaru, but two are found principally in that system. The other six belong principally to the Pareora System, one of them, *Cardita difficilis*, not having been recorded as yet from any part of the Oamaru System. The palæontological evidence, therefore, such as it is, is in favour of the beds belonging to the Pareora System, and, from a stratigraphical point of view, the unconformity lends support to this view.

The Hutchinson's Quarry beds at Oamaru have always been considered, for palæontological reasons, as the equivalents of the Mount Brown beds; and last year I showed* that probably they rested unconformably on the Ototara limestone, and belonged to the Pareora System.

It now appears that the Mount Brown beds have stratigraphically a similar position, and also belong to the Pareora System.

Again, the beds immediately above the upper limestone in Trelissick basin were referred by Mr. McKay (together with the upper limestone itself) to the horizon of the Mount Brown beds; but last year I showed that they formed the base of the Pareora System at that locality.† Consequently the view now put forth, that the Mount Brown beds belong to the lower part of the Pareora System, reconciles several different opinions, and is therefore likely to be correct.

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* "Trans. N.Z. Inst.," vol. xix., p. 421.

† "Trans. N.Z. Inst." vol., xix., Art. lii.

4. The Greta beds—as the next higher beds in the Weka Pass may be called—appear to be conformable to the Mount Brown beds, although, as the section is not continuous, such cannot be positively affirmed. No unconformity is noticed by Sir J. von Haast at Mount Brown,* and I have elsewhere remarked that at present "I cannot detect any palæontological break in the [Pareora] system."†

The following fossils have been collected in the Greta beds by Sir J. von Haast and myself. They evidently belong to the upper part of the Pareora System, and about 66 per cent. of the Mollusca are recent:—

1. *Carcharodon megalodon*, Agassiz.
2. *Purpura textiliosa*, Lamarck.
3. *Fusus australis*, Quoy and Gaimard.
4. *Fusus spiralis*, Adams.
5. *Siphonalia mandarina*, Duclos.
6. *Siphonalia dilatata*, Quoy and Gaimard.
7. *Siphonalia orbita*, Hutton.
8. *Pisania lineata*, Martyn.
9. *Nassa incisa*, Hutton.
10. *Oliva neozelanica*, Hutton.
11. *Ancillaria australis*, Sowerby.
12. *Ancillaria hebera*, Hutton.
13. *Voluta corrugata*, Hutton.
14. *Drillia wanganuiensis*, Hutton.
15. *Triton spengleri*, Lamarck.
16. *Natica neozelanica*, Quoy and Gaimard.
17. *Cerithidea bicarinata*, Gray.
18. *Struthiolaria cincta*, Hutton.
19. *Calyptra calyptræformis*, Lamarck.
20. *Turritella rosea*, Quoy and Gaimard.
21. *Turritella tricincta*, Hutton.
22. *Rotella neozelanica*, Homb. and Jacq.
23. *Zizyphinus punctulatus*, Martyn.
24. *Cantharidus tenebrosus*, Adams.
25. *Panopæa orbita*, Hutton.
26. *Corbula* (?) *dubia*, Hutton.
27. *Mactra discors*, Gray.
28. *Zenatia acinaces*, Quoy and Gaimard.
29. *Paphia neozelanica*, Chemnitz.
30. *Paphia ventricosa*, Gray.

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* "Rep. Geol. Expl., 1870-71," p. 15: No. 12 is the Mount Brown beds.

† "The Mollusca of the Pareora and Oamaru Systems": "Proc. Linn. Soc. of N.S. Wales," Series 2, vol. i., p. 266.

31. *Venus meridionalis*, Sowerby.
32. *Venus stutchburyi*, Gray.
33. *Cytherea multistriata*, Sowerby.
34. *Dosinea grayi*, Zittel.
35. *Dosinea limbata*, Gould.
36. *Cardita australis*, Lamarck.
37. *Cucullæa alta*, Sowerby (?)
38. *Pectunculus laticostatus*, Quoy and Gaimard.
39. *Pectunculus globosus*, Hutton.
40. *Pectunculus cordatus*, Hutton.
41. *Pecten diffluxus*, Hutton.
42. *Pecten neozelanicus*, Gray.
43. *Anomia alectus*, Gray.
44. *Placunanomia neozelanica*, Gray.
45. *Ostrea edulis*, Linné.
46. *Waldheimia lenticularis*, Deshayes.

These beds seem to be the equivalents of the Motanau beds, which have about 55 per cent. recent species, and to be younger than those at the lower gorge of the Waipara, which contain only 43 per cent. recent species.

Judged by the percentage test alone, the Greta beds would have to be called Pliocene, but the occurrence of *Carcharodon megalodon*—a wide-ranging oceanic shark, highly characteristic of the Miocene in Europe and North America—necessitates a greater age. The high percentage of recent species may be due, in part, to the liberal amount of variation that I allow to each species; but I do not think that this will account for all. It is, I think, evident that the dying out of old species and the introduction of new ones has gone on slower in New Zealand than in Europe; and it is to be expected that such has been the case, for the seas of New Zealand have not been subjected to the great changes in temperature which were caused in the Northern Hemisphere by the glacial epoch; nor are the facilities for immigration so great in New Zealand as they are in continental countries, or in Australia.

5. Of the silt and gravel beds that succeed the Greta beds, and to which, as I have already said, they appear to be unconformable, I will merely remark that they resemble the beds forming the low hills that lie between Amberly and the mouth of the Waipara; those forming the Moeraki Downs, south of the Ashley; as well as those of Racecourse Hill, Little Racecourse Hill, and Woolshed Hill near the Malvern Hills. Of these, Little Racecourse Hill is of later date than the time of the greatest extension of the glaciers, for it contains large angular blocks mixed up with the shingle. I suspect, therefore, that these silt and gravel beds in the Weka Pass are of post-glacier, but, at the same time, of Pliocene age.

Art. XXXII.—*On the Greensands of the Waihao Forks.*

By Professor F. W. Hutton, F.G.S.

[*Read before the Philosophical Institute of Canterbury, 1st September*, 1887.]

In the last volume of "Transactions of the New Zealand Institute" Mr. A. McKay has a paper on "The Waihao Greensands, and their Relation to the Ototara Limestone,"* which is chiefly a criticism on a paper of mine in the same volume called "Note on the Geology of the Waihao Valley in South Canterbury."† I do not object in the least to criticism; on the contrary, I think it to be the very breath of science, without which no life would remain. Also, as a general rule, I think it unnecessary to answer a criticism, believing that the original paper and the critique on it are sufficient; and that the verdict should be left to others. But in the paper just mentioned, Mr. McKay has so far transgressed the rules of ordinary courtesy that I cannot remain altogether silent; for he has accused me of deliberately omitting the names of certain species from my list of fossils from the greensands of Waihao Forks, in order to make the palæontological evidence appear to prove these beds to be of Miocene age, when in reality it did nothing of the kind. Now, whatever may be my faults, I have never before been accused of intentionally concealing or garbling the truth. Indeed it would be easy for me to show that, over and over again, I have made haste to publish corrections of my own mistakes so soon as I found that I had been in error; but if I were now to allow this accusation of dishonesty to pass unnoticed, I could never again expect scientific men to place any trust in my statements.

The following is the passage in Mr. McKay's paper to which I refer:—"According to Hutton's list of fossils, the palæontological evidence is to all appearances decisive. Sixteen species of Mollusca are known—all of them said to have come from the Waihao greensands: the collection of 1867–68, named by him in 1876; and collections (of later date?) now in the Canterbury Museum, 8 more, making 24 in all. Twenty-four, it would appear, then, are known to him, and in the Canterbury Museum; yet only 16 species are now cited by him. What of the remaining 8 species? They were sent by v. Haast to the Otago Museum and named by Professor Hutton in 1876. They are cited as fossils of the 'Waihao' in the 'Geology of Canterbury and Westland,' and now they are not! What has become of them? Lost? No; for their record remains" (*l.c.*, p. 437). On this I will remark—

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* "Trans. N.Z. Inst.," vol. xix., pp. 434–440.

† *l.c.*, pp. 430–433.

(1.) Mr. McKay's facts are not quite accurate. In my first paper (1876) I gave four species from the Waihao greensands—viz., *Natica suturalis*, *Teredo heaphyi* (= *Cladopoda directa*), *Leda fastidiosa* (= *L. semiteres*), and *Pecten hochstetteri*. Sir J. von Haast, in his "Geology of Canterbury and Westland" (1879), mentions as coming from Waihao, 16 species of Mollusca in his list of fossils of the Oamaru formation, and 3 others in his list of fossils of the Pareora formation; that is, 19 species in all, *Pecten hochstetteri* not being included. The only species mentioned by Mr. McKay in his report (1881) is *Aturia ziczac*, and this is not in Dr. von Haast's list. In my last list (May, 1886,) I included 9 of these 20 species, and added 7 others from the collections in the Canterbury Museum. There are also 3 more,* which I omitted through inadvertence: they are *Peristernia cincta*, *Mitra inconspicua*, and *Cardium patulum*; all three being found in other places in the Pareora System, and the last in the Oamaru System as well. The list therefore now comprises 19 species, of which the only one due to Mr. McKay is *Aturia ziczac*; but this one alone is sufficient to disprove the Lower Cretaceo-tertiary age of the beds, as advocated by Mr. McKay.

(2.) I omitted 11 species mentioned by Sir Julius von Haast as coming from Waihao, because they are not said to come from the greensands, and I did not find them in the collection from the greensands in the Museum. In Dr. von Haast's list all the beds at the Waihao are included, the limestone as well as the greensands, and, obviously, it would have been incorrect for me to have affiliated all these fossils to the greensands without any evidence. Mr. McKay assumes that Dr. von Haast's list is merely a copy of the one I sent him in 1875, and that I am responsible for it; but this is quite a gratuitous assumption on his part, and one which is also quite wrong.

(3.) Mr. McKay does not give a list of the species which he accuses me of omitting, and so leads his readers to infer that I have done something dreadful. I will therefore supply the names, which are as follows:—*Mitra enysi*, *Voluta attenuata* (=*elongata*), *Trochita neozelanica*, *Crepidula striata*, *Dentalium conicum* var., *Dentalium tenue*, *Cucullæa attenuata*, *Pinna distans* (?), *Pecten venosus*, *Pecten beethami* var. β, *Rhynchonella nigricans*, and the echinoderm, *Amphidotus sulcatus*.

Now, of these 11 species of Mollusca and one Echinoderm, *Mitra enysi*, *Voluta attenuata*, *Trochita neozelanica*, *Cucullæa attenuata*, and *Rhynchonella nigricans* are all found in both the Pareora and Oamaru Systems, and are therefore not distinctive of either. *Crepidula striata*, *Dentalium conicum*, and *Pecten venosus* are, so far as is known to me, confined to the Pareora System (including the Hutchinson's Quarry beds); while the other 4 are confined to the Oamaru System. But of these last, *Pinna distans* is doubtfully identified, while *Pecten beethami* var. β, and *Amphidotus sulcatus*, must certainly have come from the limestone; thus leaving (of the distinctive fossils possibly coming from the greensands) *Dentalium tenue* belonging to the Oamaru System, against 3 species characteristic of the Pareora System. Consequently, if I had admitted those species into my list they would have strengthened my argument: but I omitted them, because there is no evidence that they have been found in the greensands. Certainly these omitted species do not aid Mr. McKay in his contention that the greensands are of Lower Cretaceo-tertiary age, for two of them are recent species, and Sir James Hector says that the Cretaceo-tertiary formation contains no recent species at all;* indeed living species of Mollusca could not be expected to occur in beds of that age.

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* See "Proc. Linn. Soc. N.S. Wales," 2nd Series, vol. i., p. 203, etc. (March, 1886).

I do not care to pursue Mr. McKay further, as I am content to leave it to future geologists to judge between us; but it seems necessary to state again that, notwithstanding Mr. McKay's opinion, both *Voluta corrugata* and *Pleurotoma fusiformis* are in the collection made by Sir J. von Haast from the greensands at Waihao Forks; and as I originally described both these species, I ought to be at least as competent to recognise them as is Mr. McKay, who, although an excellent collector, has not yet shown any great acquaintance with palæontology, and who, as in the present case, carefully avoids giving a list of the fossils which he has himself collected.

One other mistake of Mr. McKay's may be corrected. He says: "Beyond all question, the greensands underlie the Waihao limestone;† and as explanations of the contrary view, islands and fiords without number, crush, faults, contortions, and, in short, all that might render the geology of a district complicated and obscure, are invoked in vain. Not merely do the sections specially examined show this; the general structure of this district, and that of all Southern Canterbury and North-eastern Otago, points to the same conclusion; and it is rare, almost never, that the Pareora rocks rest on other beds than those of Upper Eocene or Cretaceo-tertiary age" (*loc. cit.*, p. 489). Really, Mr. McKay's memory must be very bad, for he has evidently forgotten that in the map which illustrates his report on this very district in 1881 he shows the Pareora rocks (Lower Miocene) resting on the Wairoa and Kaihiku series, between Pudding Hill and the Hakateramea River,* and on the Maitai and Te Anau series to the west of Elephant Hill. Also, in the "Geology of Canterbury and Westland," (Plate of Sections, No. 5, Section No. 4,) Sir J. von Haast shows the Pareora formation resting on his Waihao formation (Older Palæozoic) between Elephant Hill and the Upper Waihao—occupying here the very same position with reference to the Oamaru formation that I have supposed it to occupy a few miles further down the river. A little reflection will, no doubt, recall to Mr. McKay's mind other localities, between Lake Te Anau in Otago and the Awatere in Marlborough, where the same thing can be seen.

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* "Quar. Jour. Geol. Soc. of London," vol. xxxii., p. 55, and "Guide to the Indian and Colonial Exhibition, N.Z. Court," 1886, p. 55.

† There are two greensands at Waihao, one of which, no doubt, underlies the limestone, but it is not the one in question, which contains Pareora fossils.—*F.W.H.*

ART. XXXIII.—*On some Fossils lately obtained from the Cobden Limestone at Greymouth.*

By Professor F. W. HUTTON, F.G.S.

[*Read before the Philosophical Institute of Canterbury, 1st September,* 1887.]

LAST January, when I was in Greymouth, the Rev. B. J. Westbrooke, F.G.S., Mr. E. Williams, and Mr. R. Helms all kindly allowed me to examine their collections of fossils from the Cobden limestone, which had been found in the quarries now being worked for the harbour works; and I was enabled to identify the following species:—

Carcharodon angustidens, Agassiz.
Aturia ziczac, Sowerby.
(This is the same as the supposed *Ammonite* from Ten-mile Creek, Greymouth, mentioned by me in my paper on the Geology of New Zealand,† and afterwards doubtfully identified with *Nautilus danicus* in "Reports of Geological Explorations," 1881, p. 74, when it was again found at Wharekauri on the Waitaki.)
Cassidaria senex, Hutton.
Voluta attenuata, Hutton.
Scalaria rotunda, Hutton.

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* In his report he says that "they rest directly on the older Palæozoic rocks," ("Geol. Report, 1881," p. 65,) but his map shows them resting here on older Mesozoic rocks.

† "Quar. Jour. Geol. Soc. Lond.," vol. xli., p. 206.

Pleurotomaria tertiaria, M'Coy.
Gryphæa tarda, Hutton (?).
Terebratella suessi, Hutton.
Terebratella gaulteri, Morris.
Terebratella aldingæ, Tate.
Holaster spatangiformis, Hutton.
Holaster cordatus, Hutton.
Pericosmus tuberculatus, Hutton.
Schizaster lyoni, Hutton.
Flabellum circulare, Tenison-Woods.

These are amply sufficient to show that the Cobden limestone is the equivalent of the Weka Pass stone, and the Ototara limestone, on the eastern side of the Alps.

Last March, in blasting the rock, some vertebræ and ribs were obtained, and presented to the School of Mines at Greymouth. Mr. R. Helms has kindly sent me a drawing of these fossils, upon which I make the following remarks: There are six vertebræ, with five ribs on one side and another detached rib lying on the other side; the vertebræ are, I should suppose, the two last dorsal and the first four lumbar. The vertebræ are said to be divided longitudinally down the middle, and they show centra which are cylindrical, considerably longer than broad, and with flat ends. There is no constriction in the middle. The length of the centra increases backwards, so that the two posterior are about 4⅔ inches in length by 8½ inches in breadth, and the two anterior vertebræ are about 8½ inches in length by 2⅔ inches in breadth. These dimensions are not to be considered as accurate, and are only intended to give some idea of the size and proportions of the centra. The neural arches are not seen, owing to the obliqueness of the section; but what I take to be the transverse processes of one side are exposed. These are nearly as broad as the length of the centra, and with a visible length of nearly twice the diameter of the centra; they must therefore be longer than this. They are set nearly at right angles to the centra, and have straight, parallel sides. The ribs are very robust, being more than an inch in thickness.

The centra of these vertebræ show that they are mammalian, and the large size of the transverse processes are either cetacean or sirenian in character. The proportion of length to breadth of the centra is greater than usual, but agrees well with some of the Ziphioid Whales, to which family I therefore refer them.

The association of a Ziphioid Whale with *Carcharodon angustidens*, *Aturia ziczac*, and *Pleurotomaria tertiaria* indicates an Upper Eocene or Lower Miocene—*i.e.*, an Oligocene—age for the Cobden limestone. So long ago as 1861 Sir Julius von Haast pointed out that the series of rocks having the Cobden limestone as its upper member rested unconformably on the

Brunner Coal series, at the place where the Davy Mountains reach the sea;[*] and the short examination I made of the Greymouth District quite bears out his views, although I did not go so far as Mount Davy.

Art. XXXIV.—*On some Ancient Rhyolites from the Mataura District.*

By Professor F. W. Hutton, F.G.S.

[*Read before the Philosophical Institute of Canterbury, 6th October,* 1887.]

These rocks were collected by M. Gordon Rich, Esq., near Waipapa Point, east of the mouth of the Mataura. They occur as more or less rounded boulders, and with them are found portions of silicified tree-fern stems, and of beautifully preserved coniferous wood, all of which probably came down the Mataura River. The vegetable remains come no doubt from the Hokonui System, and probably the rhyolitic rocks accompanying them are of the same age, or not much older. At any rate they are of considerable interest as showing that somewhere in the neighbourhood rocks of a highly siliceous character were erupted at a period not later than the Lower Jurassic; and when they are found in position, it is possible that they may furnish proof of the age of the granites which in many places pierce our Maitai rocks, which are probably of Carboniferous age.

Spherulitic felstone.—This is a compact light-grey felstone, with abundance of spherulites about a quarter of an inch in diameter. The spherulites have an opaque white centre, surrounded by a broad dark brownish-grey ring, and show no outer transparent zone. Occasionally, both the centre and the dark ring may be seen with a lens to be composed of radiating fibres, but this is not generally the case. The specific gravity of the rock is 2·54.

Under the microscope, with ordinary light, the rock is seen to be a ground-mass without any crystals. With an inch objective this ground-mass shows as a colourless glass, hazy with innumerable minute specs, which with a fifth objective often show a greenish colour. With this power, also, the transparent glass generally shows an indistinct granular appearance, but occasionally there are irregular milky patches without any appearance of granulation. The ground-mass is crossed by straight streaks and spots of a dark-greenish colour, which under the fifth objective are resolved into dark-green specks, lying in a yellowish-green base. I could detect no signs of dichroism in this yellow-green mineral. When the nicols are crossed, the ground-mass breaks up into a very fine mosaic of dark grey and yellowish white, the milky portions behaving like the granular portions. This mosaic consists of clusters of similarly oriented granules which extinguish simultaneously. When the axes of the nicols are placed at an angle of 45° most of the mosaic disappears, but as the stage is revolved some portions take a blue colour. When these portions are viewed with crossed nicols their colour is brownish-yellow.

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[*] "Report of a Topographical and Geological Exploration of the Western District of Nelson," by Julius Haast: Nelson, 1861, p. 109.

From this it will be seen that the Mataura rock is very like the felstone from North Wales described by Mr. Clifton Ward in the "Quar. Jour. Geol. Soc." vol. xxxi., p. 400, and those from Shropshire described by Mr. Allport in the same journal, vol. xxxiii., p. 454.

In sections that are nearly equatorial the spherulites always show, both in ordinary light and in crossed nicols, a radiating structure from the centre through the dark ring. In more tangential sections this structure of course becomes obscure. The radiating fibres stop abruptly at the junction of the ring with the granular ground-mass, and there is no appearance of an intermediate hyaline zone. But where two spherulites meet, rather large grains of quartz have sometimes been developed, and these quartz grains are also occasionally seen in the spherulites themselves, either in the centre or in the ring. The long green streaks, mentioned as occurring in the ground-mass, run into or even quite through the spherulites without disturbance.

Another specimen of the same kind of rock has numerous small spherulites without any ring scattered through the base. These spherulites show a fixed interference cross, and the rock passes in places into a laminated felstone.

2. *Perlitic felstone.*—This is a green rock, weathering paler, with veins and nodules of chalcedony, and a hand specimen might easily pass for chert. Its specific gravity is 2·50. Under the microscope, in ordinary light, the ground-mass is a colourless glass with numbers of dark chrome-green specks. These specks are gathered thickly together in curved bands, which imitate exactly the perlitic structure of many vitreous rhyolites. Between crossed nicols the ground-mass is anisotropic, but it shows no mosaic. The chalcedony calls for no special remarks.

3. *Laminated felstone.*—There are several varieties of these. In some the laminæ are pink and white, in others grey and white. In thickness the laminæ vary from very minute up to 0·05 inch. Sometimes they are approximately parallel; in

other places they are twisted, contorted, and broken off in all manners of ways; in fact they resemble in this the laminated rhyolites so common about Lake Taupo. The specific gravity is about 2·58. I have only prepared thin sections of one specimen, as they are extremely hard, and more are not necessary for my present purpose, which is merely to draw attention to the existence of these rocks. This specimen is one of those with pink laminæ, and it shows under the microscope the ordinary felstone structure, with a mosaic between crossed nicols, which vanishes when the nicols are oblique. The pink bands are due to minute specs of ferric oxide in a more opaque base. I should judge that the original lava contained two *magmas* differing in their amount of iron oxide, and that in the more ferriferous laminæ some of the iron has segregated into minute globules.

There can be no doubt but that all these rocks are devitrified rhyolitic lava streams.

ART. XXXV.—*On a* Leucophyre *from the Selwyn Gorge.*

By Professor F. W. HUTTON, F.G.S., and G. GRAY, F.C.S., Lecturer on Chemistry at the School of Agriculture, Lincoln.

[*Read before the Philosophical Institute of Canterbury, 6th October*, 1887.]

THIS rock was first noticed by Sir James Hector, as greenstone (diabase ?) occurring in the gorge of the Wakaepa (or Selwyn) in the Malvern Hills,[*] and is shown on his section (*l.c.*, iv. *c.*) as interbedded with slate rocks, and forming an anticlinal. Sir Julius von Haast, in his "Report on the Geology of the Malvern Hills," mentions them under the name of diabasic rocks,[†] associated with chertsose rocks and marble. Also in his "Geology of Canterbury and Westland," (p. 271) as diabase ash-beds. In "Reports of Geological Explorations for 1883," p. 29, Mr. S. H. Cox mentions these diabases, and says that he agrees with Mr. A. McKay that they are the same as the diabase ash-beds and cherts of Okuku which he had found to contain triassic fossils[‡] Mr. A. McKay in "Geological Reports, 1884," (Bulletin of Geological Survey, No. 1,) p. 7, describes them as diabasic rocks with jasperoid rocks, either slates or resembling tufaceous sandstone, grey or reddish limestone, crystalline or compact at different horizons in the diabasic beds, with grey cherts and manganese ore. He considers that this series rests unconformably on the 'Annelid beds,' which latter he thinks form the upper part of the Maitai series.

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[*] "Rep. Geol. Expl." 1870-71, p. 49.

[†] "Rep. Geol. Expl." 1871, p. 136; and 1871-72, p. 10

[‡] "Rep. Geol. Expl." 1879-80, p. 99.

Last summer one of us examined these rocks in the field, and agreed with former observers that they were volcanic ashes and lava streams contemporaneous with the sandstones and mudstones among which they are found. In places, near their margins, considerable decomposition has gone on, and the green rock is penetrated by bright-red siliceous veins, coloured by ferric oxide, forming the so-called red cherts and jasperoid rocks. Calcite veins are often associated with these jasperoid portions, giving further evidence of decomposition, and in places the calcite forms segregation masses from 20 to 25 feet thick, which have been called marble, or even limestone. However, their irregular and lenticular shape, as well as their intimate junction with the greenstone along the line of junction, as well as the mineralogical character of the calcite, which does not resemble limestone but vein calcite, all go to prove their real nature. Small quantities of copper and manganese have been found associated with these rocks; and rocks from Okuku, said to be lithologically similar, called ferruginous cherts, contain a small percentage of gold.*

The undecomposed igneous rock is compact, of very fine grain and of a darkish-green colour, too fine-grained to call a diabase and too light-coloured to call melaphyre; it answers better to the old name of aphanite. The hardness is about 4·5 or 5, and the specific gravity varies between 2·96 and 3·05. On the points it has a greasy lustre like serpentine, but not so well marked.

With an inch objective and ordinary light the rock looks granular, numerous small colourless or pale olive-brown, much cracked, crystalline grains in a translucent mesh-work of ground-mass which is milky or cloudy with occasional whitish patches of leucoxene, and rarely black specks of iron ore. With reflected light the ground-mass is very pale-green, and the crystallized mineral is colourless. The iron ores are pyrites and a brownish-black oxide, no doubt ilmenite; the pyrites is rare. With crossed nicols the crystallized mineral shows brilliant polarization colours. Crystalline faces are rare, the mineral being generally in coarse granules, which look as if they had been broken apart; but on revolving the stage, it is seen that the grains have generally independent orientation, although sometimes two grains separated by ground-mass extinguish together. But there are no large single crystalline masses. These grains are mostly of a pale yellowish-green colour, but some are darker and of a brownish-green. None are pleochroic. Occasionally pale-green chloritic particles occur, which are very faintly, if at all, pleochroic.

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* "Rep. Geol. Expl." 1879-80, p. 105.

With a quarter-inch objective the crystallized mineral looks much like olivine, as it is irregularly cracked and has a roughish surface; but the grains are sometimes cleaved in one direction which is oblique to the positions of extinction; the surface is not so rough as that of olivine, and they show no trace of decomposition on the cracks. Probably, therefore, they are augite, although they show no twinning, and this supposition is confirmed by the chemical analysis. These crystalline grains contain numerous minute irregularly shaped, but generally angular, bright particles, generally of a greenish hue; and sometimes short dark lines, curved or straight. Minute liquid-cavities, occasionally with a bubble, can be found, but are rare.

The ground-mass is a finely granular crypto-crystalline mass, of low polarization colours, colourless or very pale greenish, and consists of a water-clear colourless glass with numerous short rods and minute irregularly-shaped particles. In fact, it is saussurite.

The chemical composition of the rock is as follows:—

Percentage Composition.

Hygroscopic moisture	·30
Loss on ignition	2·81
Silicic anhydride	47·41
Aluminic acid	12·66
Ferric oxide	10·88
Ferrous oxide	2·52
Manganous oxide	·78
Calcic oxide	11·21
Magnesic oxide	7·42
Potassic oxide	·22
Sodic oxide	2·92
Carbonic anhydride	·26
Loss, and undetermined	·66
	100·00

Specific gravity 3·048.

This analysis shows that there is little or no olivine in the rock, but that it is composed roughly of about two-thirds of a lime-magnesia augite* and one-third labradorite with some iron ore; while microscopical examination shows that the iron ore is ilmenite, and that the labradorite has been converted into saussurite. The rock, then, consists of a pale-green augite (diopside?) in a more or less abundant base of saussurite, through which is scattered some ilmenite, and occasionally a chloritic mineral. A second brownish-green augite is also present. This answers very closely to Gümbel's definition of leucophyre, as quoted by Teall,* except that in our rock the augite is in very considerable quantity.

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* Of approximately the same composition as that from the Whin Sill, described by Mr. Teall in "Quar. Jour. Geol. Soc.," vol. xl., p. 648, but with less iron.

This, therefore, may be taken as the name of the rock. It differs from dolerite in the subordinate position of the felspar and in the green augite; it is, in fact, an augite rock with some plagioclase and iron oxide; sometimes, however, the saussurite appears to be as abundant as the augite. That it is an altered rock is undoubted, and it may perhaps be an altered dolerite. Its granulitic texture shows that it consolidated during movement, and its association with beds of volcanic ash shows that it is an old lava stream, probably of Triassic age.

Art. XXXVI.—*On the Oxford Chalk Deposit, Canterbury, New Zealand.*

By Henry Wilson, B.A.

[*Read before the Philosophical Institute of Canterbury, 2nd June, 1887.*]

Plate XV.

The Ashley County seems peculiarly rich in interesting geological formations, but to none does more interest attach itself than to the small patch of chalk near Oxford. This chalk was reported on as far back as 1881 (*vide* Geological Reports), by Mr. McKay, of the Geological Department. Mr. McKay's report of the bed is so accurate that my description must in part traverse his. There are, however, some interesting particulars with regard to the fossils contained in the chalk that have been passed over in his report, and to these I shall have the pleasure of calling your attention. Besides the question of fossils, there is the interesting question of the distance from land at which a chalk, almost as free from impurities as English chalk, may be formed.

This chalk, then, is situated in and almost wholly composes one small hill: this hill forming, in one direction, the extremity of the bush-clad hills lying around the base of Mount Oxford.

As will be seen by a reference to the accompanying diagram (Plate XV.), the hill is skirted on three sides by streams; while on the fourth there is a valley, so that the chalk hill is, to use a Scotticism, "self-contained."

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* "British Petrography," p. 185.

The dip of the chalk cannot be absolutely made out, as it is so much obscured by bush and alluvium; but from observations I made upon the greensand by which it is underlain, there can, I think, be little doubt but that its dip is about 27° to the south-east. This, too, is the conclusion Mr. McKay comes to. Beneath the chalk, as I have just noticed, is a bed of greensand; above it is a layer of basaltic rocks, whose decomposition appears to have given rise to the soil bearing the bush covering the whole hill. At the point marked *L* in the accompanying diagram, and within a few yards of the chalk section, what appears to be a dyke of this basalt has assumed a columnar form in cooling.

Mr. McKay, from his report, seems to have had some doubt as to whether the chalk (?) outcropping at *L* was the exact equivalent of that at *M*. Until the bush is further cleared, exposing other sections, this of course cannot be absolutely determined. I was, however, fortunate enough to obtain specimens of *Pecten williamsoni*[*] from each section.

P. williamsoni, I may remind you, is found at Aotea and Raglan, North Island; Kaipuke and Tata Cliffs, Nelson; Black Birch Creek, north side of Hurunui Plains; and from the Curiosity Shop, on the Rakaia. The other fossils from each section, so far as my investigations have carried me, differ considerably from each other.

At *L* I obtained (2nd) *P. fischeri.*[†] This fossil was originally described from Papakura, near Auckland. Since then it has been found at Port Waikato, Oamaru, and Weka Pass.

3rd. *Cristellaria* (*Robulina*) *cultrata*, D'Orb., var. *antipodum*, Stache.[‡] Hitherto only found at Raglan.

4th. Several varieties of *Pecten* hitherto undescribed. The presence of these fossils, so characteristic of the Oamaru System, leaves no doubt as to the age of the chalk.

At *M*, where the chalk is much freer from silica, I found it composed very largely of Foraminifera. A section ground thin and placed under the microscope exhibited many coccoliths. The only large fossil, however, that I have been able to discover at this outcrop, in addition to *Pecten williamsoni*, is a rather abundant brachiopod, hitherto undescribed, but apparently allied to *Terebratulina lenticularis*, Tate.

The presence of the Foraminifera and coccoliths at once point to the conclusion that the deposit is a true chalk, and not a mere limestone; but the following comparison between its chemical composition and that of the English chalk leaves no doubt upon the subject:—

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[*] "Voy. Novara," plate ix., fig. 11, p. 50.

[†] Zittel, plate ix., figs. 1 and 2, p. 53.

[‡] Palæontology of "Novara Expedition," plate xxiii., fig. 30.

From Colonial Laboratory Reports, Wellington, 1879–81.
(*Mr. W. Skey, Analyst.*)

	NEW ZEALAND CHALK *			ENGLISH CHALK (Average)
	A	*B*	*C*	
Carbonate of lime ..	82·26	82·26	66·82	94·59
Carbonate of magnesia..	1·84	..	..	2·01
Alumina	..	1·84	0·92	Trace
Iron oxide	Traces	Traces	Traces	Trace
Silica and insoluble silicates	15·69	15·69	32·10	3·16
Water	·21	·21	·16	·24
	100·00	100·00	100·00	100·00

A, *B*, and *C*.—From section at *M*; but *C* from a lower level than *A* and *B*.

You will please observe the differences in the analyses of *A* and *B*, and *C*, with regard to the percentages of silica in each. Now at the section marked *L* in diagram the percentage of silica is about 50. In the lowest part of the chalk exposed at *M* the percentage is 32·10, decreasing in the upper part of the bed to 15·69.

The dip, as shown in accompanying diagram, is towards the south-east—that is, towards *M*. Now, taking all these facts into consideration—the presence of *P. williamsoni* in both; the decrease of silica as we ascend in the chalk at *M*., and the dip of the bed, there can, I think, be no reasonable doubt but that the marl at *L* and the chalk at *M* are one and the same bed, the marl being the lower and the chalk the upper deposit.

At the time of the deposition of the bed, Mount Oxford (4,892 feet high), distant about five miles, must have existed as an island, whence disintegrated rock would be borne to the sea. The high percentage of silica in the lower beds points to comparatively shallow water. Gradually the coast sank; less and less silica was deposited among the chalk; and, finally, the water became pure enough to admit of the growth of a coral reef, teeming with Foraminifera.

But the elevatory agencies reassert themselves; the coast rises. Volcanic disturbance follows long ages of tranquillity: basaltic lava streams flow, where formerly the quiet lagoon existed; but although they may have obliterated the beauty of the scene at the time, yet to them we owe the preservation of this exceedingly interesting record of a portion of the past history of our island.

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* Specimens collected by Mr. John Ingram, Lab. Nos. 2597 and 2819.

ART. XXXVII.—*The Tarawera Eruption, 10th June, 1886.—A Criticism of Professor Hutton's (and others') Explanations of the Causes of the Eruption.*

By J. HARDCASTLE.

[*Read before the Hawke's Bay Philosophical Institute, 8th June,* 1887.]

A REPORT has been published by Professor Hutton, F.G.S., on the Tarawera Volcanic District in which he gives the conclusions he arrives at, after a visit to the locality and a study of a subdued phase of activity, as to the causes of the eruption in June, 1886. Those conclusions, it is to be inferred from a foot-note to page 12 of the report, are concurred in by Professors Thomas and Brown.

The explanation given of the cause of the eruption appears to me so much at variance with the probabilities of the case, as to invite criticism, especially as the general theory of volcanic action is involved. (See Report, pp. 14 to 18.)

Undoubtedly Professor Hutton is right in concluding that "the cause was local,"—"in the mountain," he says, italicising these words; "beneath the mountain" would surely be more correct, according to his own explanation. He is right, also, in saying that the heat "could not have been caused by upward conduction, through the solid crust, of the internal heat of the earth." Undoubtedly right also in concluding that "no chemical changes, at all competent to do the work, suggest themselves as the cause of the re-heating of the surface rocks." Having put aside these as incompetent causes, he mentions two others: the production of heat by (1) the crushing of rocks, and (2) the rise of a quantity of molten rock from somewhere in the depths of the earth. The first of these he dismisses after a very imperfect examination, as "very improbable;" the second he accepts as the true cause, though he shows that both the alternative modes by which it is suggested such uprise of molten rock might be brought about are open to objection, and makes no attempt to answer the objections to either, and expressly declines to choose between them.

I propose to show that the explanation put aside as "very improbable" is the most probable, and the true cause, and that an uprise of molten rock is very improbable.

In the first place, there is no evidence of an uprise of molten rock at all, in such quantity as would be necessary to re-heat all the rock that was ejected, and to vaporise all the water which, as steam, supplied the ejecting power. Professor Hutton finds such evidence in the earthquakes which for some months preceded the eruption. These, however, were in no way remarkable, and they afford no evidence as to their cause. Such an addition, as that supposed, to the mass of the crust beneath

Mount Tarawera, should have been indicated by other and distinctive signs than mere earthquakes, as by changes of levels, disturbance of springs, and so forth. No such signs are mentioned. It will scarcely be suggested that there existed an enormous cavity beneath the mountain, void even of water, of which the supposed molten rock took possession, and where it remained quietly stowed away while performing the heating work attributed to it. But if not, where was it bestowed, that no unmistakeable sign of its presence was manifested? And where is it now? Professor Hutton says all the matter ejected was re-heated surface-rocks. Then the supposed mass of molten rock must still be a source of danger. It must have retained at the close of the eruption at least as high a temperature as it had imparted to the rocks heated by it, and that was of volcanic intensity. Or has it retreated to the abyss whence it came? This explanation is prolific of puzzles, and more are provided by the modification made in it to account for the different nature of the eruption from the craters on the plains.

Not only is there no evidence that any uprise of molten rock took place, but both the modes by which it is suggested such an uprise could take place are, I believe, inefficient. One involves the admission of a thin crust over a fluid or plastic interior. The physico-astronomers disallow that. They threaten to stop tides, and twist and wrench the crust about every day unless that idea is given up, so the sooner it is given up the better. The alternative, that the molten rock is forced up by water expanding into steam, or by the expansive force of other gases imprisoned down below among the molten rock, must, I believe, be also given up. I hope to have opportunity to show on a future occasion, in some detail, that at no depth at which molten rock can reasonably be expected to be met with, according to this hypothesis, can steam or expansive gas of any effective force be formed at all. The familiarity we possess with the power of steam, and with the tremendous work it does in active volcanoes, has caused inquirers to neglect inquiry, and to attribute to high-pressure steam powers which it does not possess, and to credit it with work which it is really incapable of. Hot water, however hot, is not omnipotent. There are fixed relations between the temperature, density, and pressure of steam; and just as our boiler-makers can, and do, shut it down at a temperature of 400° or so, by means of a few quarter-inches of steel plate, so gravitation, working through a few miles of rock, can keep it in subjection at 2,000°. Steam plays an important part in most (not in all) volcanic eruptions; but it is not the prime cause.

I now turn to the explanation which Professor Hutton discards as "very improbable," the production of volcanic heat by rock-crushing.

This theory was originated by the late Mr. Robert Mallet. In working it out he, at some expense, had massive machinery constructed by means of which he crushed small cubes of various kinds of rock, and noted the force required to crush them. By means of other apparatus he measured the amount of heat generated in the fragments by the work of crushing. The amount of heat developed, as was to be expected from the law of conservation of energy, was always in proportion to the force employed. Having ascertained from the researches of others the annual loss of heat by the globe, he calculated the amount of contraction due to such loss of heat, and from the results of his crushing experiments calculated that the annual contraction, in terms of descent of the crush, must furnish power enough to crush an amount of rock that would be sufficient, and more than sufficient, to yield all the heat required for the average annual display of all kinds of volcanic activity. This calculation may have been perfectly correct; but it will not apply to particular cases. Professor Hutton points out the flaw in Mr. Mallet's theory: So many times the amount of rock to be fused must be crushed, and then all the heat developed must be focussed in a small portion of the fragments, which is an impossibility. (It is some years since I read Mr. Mallet's treatise, and I have only a few extracts and notes from it by me; but I think I have stated his theory and its defect fairly. Professor Hutton's allusions to it corroborate my memory so far as they go). Mr. Mallet made the mistake of reasoning directly from his machinery to the volcano, and unfortunately mislaid the germ of what I contend is the true theory, while attempting to bring the matter as a whole into subjection to arithmetic. His experiments were made with small cubes of stone, unsupported at the sides, and the average force required to crush them was—I gather from one of my notes—about 15 tons per square inch of the upper surface. Had he reproduced as far as possible the conditions under which rocks must be crushed in nature, when buried under a few miles of other rocks—had he enclosed his cubes in a strong steel box, or tried to crush the central portion of a slab strongly bound round the edges, he would certainly have had to apply much greater pressures to crush them, *and would have obtained proportionately higher temperatures in the fragments*, since the heat developed is in proportion to the force employed. Professor Hutton says ten volumes of rock must be crushed to furnish heat enough to fuse one volume. Possibly that is a conclusion from Mr. Mallet's experiments. Then, if the crushing of a piece of rock unsupported at the sides developes heat enough to fuse one-tenth of it, and if crushed under other circumstances ten times the force is required, in the latter case, ten times the heat being developed, *the whole will be fused.*

It cannot be doubted that beyond a mile or two beneath the surface the rocks are so well supported on all sides that enormous force must be required to crush them. Under such circumstances there can, of course, be no crushing into fragments. The conditions preclude any separation of the parts or particles to form interstices. But any change of shape, any forcible deformation, producing movement of the component particles amongst each other, would be equivalent to crushing to dust, so far as development of heat is concerned; possibly more than equivalent, since in crushing to dust power is absorbed in overcoming cohesion, and, I apprehend, does not reappear as heat; whereas it is conceivable that in deformation merely less of the force is so absorbed.

If a pressure of ten times 15 tons per inch is sufficient to fuse average rock, and, say, 300 or even 500 to fuse harder rocks, such pressures are available for the purpose. They are mere fractions of the stupendous pressures that the collapse of the crust would give rise to, if the rocks were rigid enough to call them forth. The possible crust pressures exceed 5,000 tons per inch, which gives a wide margin of crushing force over any possible resistance. The conversion of the work of the extreme pressure into heat would give solar temperatures to a considerable quantity of rock; so that the crushing theory easily accounts for terrestrial volcanoes, giving as wide a margin of temperature, almost, as of crushing power.

This development of Mr. Mallet's theory completely disposes of Professor Hutton's dust-heap objection; and the remainder of his "difficulties," those relating to the earthquake observations, instead of being difficulties, are proofs of the correctness of the crushing theory. There had been occasional earthquakes in the locality for some months before the eruption, indicating (for that is what an earthquake does indicate) that some portion of the crust was in motion, yielding to contractile pressures in some direction or other. Those crust movements may have occurred, but by no means necessarily so, in the exact region where the volcanic outburst afterwards originated, and they may have had much or little to do with bringing about the catastrophe. It is impossible for any massive movement in the crust to occur without heating in some degree the rocks which are crushingly affected by the movement, whether by friction of opposed surfaces, or deformation of larger or smaller masses. There may, however, be movements producing violent earthquakes which do not result in the heating of rocks up to fusing point, or to a temperature capable of vaporising water under the pressure due to the depth. On the other hand, a series of small movements, indicated by slight earthquakes, successively attacking and deforming the same mass of rock, will successively increase its temperature, even up to fusing point, if the attack be sufficiently sustained—if the pressures are equal to the production of the temperature required, and the series is not extended over too long a time. But fusion of a considerable quantity of rock might be effected by a single movement, under conditions which may exist in some spaces in the crust from time to time.

In the case of the Tarawera eruption, the evidence seems to show that there had been slight crust movements going on, intermittently, for some time (indicated by slight earthquakes); and as the earthquakes which immediately preceded the eruption were not violent, (not indicative of enormous crushing effect,) we may conclude that a preliminary series of attacks had been made upon a region of rock beneath the mountain, possibly raising its temperature to a high point, yet short of that necessary to form steam under the pressure due to the depth of the field of action; that on the night of the eruption, further movements, slight in themselves (as indicated by slight earthquakes) but critical in direction and the amount and nature of the deformation produced, raised the temperature of some portion of the deformed region so much that it was fused, and the water in this and adjacent portions was enabled to expand into steam, and that the steam, finding an old or a new fissure by which to commence its escape, quickly enlarged this into a wide rift, up which it bore millions of tons of crumbled, rocky matter. Heavier earthquakes followed the outbreak, caused, not by explosions of steam, but by crust movements becoming more extensive, conceivably facilitated by the removal of portions of the previously resistent rocks by ejection, or by the fusion and squeezing out of the way of a portion, or by both means together.

The eruption from the plain commenced later, and a difference is noted by Professor Hutton between the ejections from the craters on the mountain and those on the plain—fused rock being discharged from the former, none from the latter. I would suggest that the explanation of this difference is this: that more powerful pressures were required to carry on the work of contraction beneath the load of the mountain than beneath the plain, and the effective exercise of the higher pressures developed a higher temperature. The difference in the time of the outbreaks may be accounted for in this way: Previous crust movements in the same direction may have proceeded in some degree beneath the plain, while being retarded beneath the mountain by its weight. The pressures directed under the mountain accumulated until they overcame the extra resistance, and that so effectually that renewed and sudden strain was thrown upon the related rocks under the plain (related as to liability to compression), which strain they were unable to resist. Just as if one were pulling a carpet on which stood a heavy box, the carpet would be pulled forward on each side of the box; if a special pull were given to move the carpet beneath the box, that on each side would yield again. The difference of temperature may, however, be otherwise accounted for, and possibly other explanations might be suggested. The pressures, and the distance through which they acted, may have been equally great beneath the plain and the mountain, but the quantity of rock deformed beneath the plain may have been larger; in which case the heat developed, being spread throughout a larger mass, would not be so intense. Seeing that the larger portion of matter ejected issued from the lower range of craters, this appears to be the most reasonable suggestion of the two.

In the case of both eruptions, the relief afforded by the removal of matter at some points would cause greater strain to be thrown on other points, and these yielding in their turn, (the yielding being indicated by the earthquakes accompanying the eruption,) heat, and consequently steam and weakened rock, were provided for the continuance of the volcanic display.

Other facts, recorded by Professor Hutton and others, might be mentioned to show that the crushing theory fits them perfectly; but this paper has run to great length already, and I hope I have sufficiently shown that Mr. Mallet's theory, properly understood, is not so "very improbable."

Art. XXXVIII.—*On the Artesian Well System of Hawke's Bay.*

By H. Hill, B.A., F.G.S.

[*Read before the Hawke's Bay Philosophical Institute, 13th June, 1887.*]

Plates XVI., XVII.

Few things add more to the conveniences and general health of a town or a district than a good water supply. Happily for the people of Napier, and for those dwelling on the plains known as the Ahuriri, the Karamu, and the Heretaunga, they have a supply of good well-filtered water which is practically unlimited.

The discovery in this district of what are known as artesian wells, dates back a good many years. The first well sunk in Napier was the one in Hastings Street, near Mr. Swan's brewery, Mr. Garry, so long and so well-known in connection with Garry's foundry, being the gentleman who successfully carried out this important and beneficial work. It ought also to be recorded to Mr. Garry's credit, that he was the first to discover artesian water in the Poverty Bay District, he having sunk the famous well at Makaraka, four miles from Gisborne, in the year 1877, which, in addition to providing a fair water supply, throws off sufficient luminous gas to be employed on special occasions for lighting the hotel near by.

It is estimated that there are in Napier and the surrounding district not fewer than three hundred artesian wells. I am inclined to think that the number is under-estimated, as I find that within the Hastings Borough boundaries there are at least ninety wells; and Mr. J. N. Williams, Mr. Coleman, and Mr. Tanner have fifty others between them. But the estimate is quite sufficient for my present purpose. These wells have a varying flow, dependent in a great measure upon the diameter of the tube or bore, as it is technically termed, which is driven into the ground by means of a heavy weight until the water-bed is reached. The flow of water, however, is not proportional to the diameter of the tube bores. Thus a pipe of 2-inch bore has been known to give a flow of water averaging nearly 60 gallons a minute, whilst a 3-inch pipe never exceeds, under the most favourable conditions, a flow of 100 gallons a minute; the proportion being in these cases as 3 to 5, whilst the area of the bores is in the proportion of 4 to 9. The cause of the diminished flow in the larger pipes is to be accounted for, so I imagine, by the fact that the friction produced by the movement of the water in its underground course through the shingle-bed where it is found retards the rate of supply much more in the larger pipes than in the smaller ones.

The Napier Borough water supply is provided for by means of six artesian wells, four of them having a 3-inch bore, and the others a 2-inch bore. The estimated quantity of water which flows daily from these wells is set down at 420,000 gallons, or an average of nearly 50 gallons a minute for each well. Now, if we take 50 gallons as the average flow per minute for each of the 300 wells which I have supposed as flowing throughout the Heretaunga Plain, the daily water supply will amount to 21,600,000 gallons, and the annual supply to the enormous number of 8,884,000,000 gallons, or say 40,000,000 tons, the greater portion of which is allowed to run to waste, or is employed for irrigation purposes.

The exceeding value of the artesian water supply to the well-being of the people in Hawke's Bay has been well exemplified during the past year or two. As we are all aware, the district has suffered more or less from a diminished rain supply for the past three years, the climax being reached during the year ended in March last. For the twelve months which ended at the close of the first quarter of this year, it appears that only 15 inches of rain fell on the Heretaunga Plain about Hastings, whilst in Napier barely 17 inches fell during the same time.

The average rainfall for Hawke's Bay is given in Dr. Hector's "Handbook" as 36 inches, and for Napier 37·260 inches. The latter is the average of twelve of the years between 1866 and 1881, no rainfall being given for the years 1867–69 and 1881. As far as I can gather from the statistics of rainfall already published, this district has suffered from a diminished rainfall at regularly recurring periods. In 1866 there was a deficiency in the rainfall of 7·260 inches; in 1872, or six years later, the deficiency was 13·320 inches; in 1878, or six years later, the deficiency was 16·160 inches; whilst during the year ended March last, or say eight years later, the deficiency was actually 21 inches on the Heretaunga Plain, and 20·260 inches at Napier! It is curious that in each year succeeding what might appropriately be termed the "drought year," there was an excess of rainfall, so that, during the present year, we may expect, if not floods, certainly many rainy days to make up for the unusual deficiency in the rainfall of the past year.

Now if we consider the Heretaunga Plain and the slopes of the hills which naturally drain their surplus waters into it as containing 100,000 acres, we may readily compare the quantity of water that fell within this area last year with the quantity that should have fallen to supply the ordinary requirements of the district, had the normal rainfall been maintained.

The weight of an inch of rainfall over an acre of ground may be stated roughly as 100 tons. Actually it is 101¼ tons: for 36 inches of rainfall, the weight on an acre, amounts to 3,600 tons. This is the quantity of rain that should have fallen last year on every acre of land on the Heretaunga Plain. The quantity that actually fell was 1,500 tons. On the 100,000 acres which I have assumed to constitute the drainage area of the plains, 150,000,000 tons of water fell last year, whilst 360,000,000 tons ought to have fallen had the average rainfall for the year been maintained. Thus the year's deficiency was 210,000,000 tons, or a quantity represented by no fewer than 47,060,000,000 gallons. I estimate that, under ordinary conditions of soil and temperature, an inch of rainfall would moisten the ground for a depth of 6 inches, that is supposing no portion of it was allowed to pass away either by evaporation or by drainage in the way of surplus soakage. Consequently, 15 inches of rainfall would moisten the ground to a depth of 90 inches, or 7 feet 6 inches. At this depth it may be said that the ground is generally moist and damp. It is evident, therefore, that, without considering the question of bedding, the district under notice had no surplus soakage last year to maintain the artesian supply, which I have already pointed out amounts, at the lowest possible estimate, to 8,884,000,000 gallons per annum; and either the supply was the accumulation of previous years of soakage, or it is obtained from some outside source. I am well aware that water percolating through rocks of greater or of less porosity may take a long time to reach what is termed an impervious bed, from which, by means of fissures, it may again be forced to the surface as natural springs. The best spring-water in England is considered by those who are supposed to be capable of giving an opinion on the matter to percolate through rocks for many years, and the "more aged" the water the better in quality it is supposed to be—after the manner of old wine. We have it on high authority that the water used for the supply of the Town of Aylesbury, in Buckinghamshire, England, is obtained from the chalk rocks of the Chiltern Hills, and that it takes two centuries for the rain to percolate through the chalk into the wells from which the Aylesbury town authorities obtain their supplies. Thus it may happen that the rain which fell a century or so ago upon the Napier Hills, and upon the hills surrounding the Heretaunga Plain, and extending from the Kidnappers, past Havelock and Pakipaki, thence rounding to the north-west to Maraekakaho, then north-east and north towards Taradale, is just reaching the impervious beds underneath the plain, and is now coming to the surface by means of artesian wells to supply the requirements of Napier and the surrounding district.

Let us see what light geology throws upon this interesting subject.

Most of those who have resided in this district for any length of time are aware what great modifications have taken place in the surface of what is commonly known as the Napier Swamp, in consequence of the heavy floods which have occurred from time to time.

Only a few years ago the Township of Meanee was inundated, and the land thereabouts was raised in height varying from 2 to 5 feet. One can hardly realise that, within the memory of many now living here, the tide used to rise 2 feet 6 inches in the swamp midway between Awatoto and Waitangi, or that a respected Napier citizen used to ply a 5-ton boat between Napier and Pakowhai; and yet such are the facts. The flooding of the plain has been going on at intervals for many centuries, and it is chiefly by this means that the waters of the bay came to be divided from the land. The whole plain is an alluvial deposit of comparatively recent formation; indeed, as the Napier Swamp now testifies, it is an unfinished work, which the physical agencies, air, water, and climate, were doing so well when civilized man entered upon the scene to hurry on the work, and to adapt the land for the supply of his needs. And here I would digress for a moment to say how much I hope that our President will succeed in obliterating, by means of his proposed reclamation scheme, the last remnant of the swamp plain, which, though interesting from a geological standpoint, will be much more interesting when made suitable for the abode of man.

As showing the vast and comparatively rapid changes that have taken place in the facies of the plain within the memory of some of those who are amongst our oldest and most honoured members, I quote the following interesting description by the Rev. W. Colenso, F.R.S., taken from his paper describing his first, and to me, remarkable journey over the Ruahine Mountain Range, so long ago as the year 1845, or forty-two years since. Mr. Colenso says: "I have mentioned the trackless mountain forests of the Ruahine, but, if anything, some of the open swampy plains near the sea in Hawke's Bay were worse. I may particularly notice the present well-known extensive grassy plain lying between Farndon and Pakowhai—then a long peninsula bounded by water on three sides. Words would fail me to show the original state of that land. In those days there was no communication overland between the villages (Maori). . . I have often, of late years, asked myself which of the two wonderful alterations or changes—the building of the town of Napier, or the great transformation of those swamps, I considered the most surprising, and I have always given it in favour of the plains."

The height of the plains, which, for simplicity, I shall call the Heretaunga Plain, varies considerably, although between Awatoto and Pakipaki it appears to be almost a dead level. Through the kindness of Mr. Rochfort, C.E., our townsman, and engineer of the Hastings Borough drainage scheme, I have been put in possession of data showing the various heights of the plain between Maraekakaho and the sea—Mr. Rochfort having taken many hundreds of observations, with the object of providing against the alteration in the bed of the fickle Ngaruroro. At a point on the plain a mile or so to the west of Roy's Hill, near Maraekakaho, and about 15 miles south-west of Napier, where some years ago important embankment works were carried out on the right bank of the Ngaruroro, the height of the plain is 166·40 feet. For our purpose this may be set down as the highest point on the plain. From this place to the sea-beach near Awatoto the distance is about 14 miles. Between Pakipaki and Awatoto the distance is about 18 miles. Pakipaki is 82·30 feet above sea-level. Havelock, at the bridge over the old Ngaruroro river-bed, is 84 feet above the sea. East Hastings, at the junction of the Karamu and Havelock Roads, is 89·90 feet. West Hastings is 44 feet. Omahu, at the bridge, is 78 feet, at the pa 68 feet, and at the mill 48·2 feet. At the junction of the Clive-Havelock and Clive-Hastings Road the height of the plain is 15·86 feet. At the Clive Bridge Hotel the height is 11·54 feet; near the bridge at the Waitangi the height is 7·29 feet. Pakowhai is 18·47 feet above sea-level; Papakura is 36 feet; Redcliffe, near Mr. Williams's blue gums, is 25·17 feet. Taradale, at the junction of the Meanee and New Taradale Roads, is 16·63 feet; and Meanee, near the hotel, is 5·31 feet; whilst Awatoto is 7 feet. From these data we are able to form an estimate as to the general slope of the plain, starting from the given point to the west of Roy's Hill. Thus between the starting point and Pakipaki, a distance of 8 miles, the slope is 134 feet, or 16·8 feet per mile. Between Roy's Hill and Havelock, a distance of about 10 miles, the slope is 132·4 feet, or 13·24 feet per mile. Between Roy's Hill and Awatoto the distance is about 14 miles, and the slope is about 11·3 feet per mile; whilst between Pakipaki and Awatoto the slope is little more than 2 feet per mile. From these results we gather:—

First. That from Maraekakaho to the sea there is a gradual slope amounting altogether to 166·4 feet.

Second. That the slope is much greater between Roy's Hill and Pakipaki, that is to the east, and between Roy's Hill and Havelock, that is to the east by north, than it is between Roy's Hill and Awatoto, that is to the north of north-west.

Third. That the lowest portion of the plain is between Pakipaki and Awatoto, by way of the old Ngaruroro river-bed, the slope being only about 25 feet; whilst between Hastings and Awatoto the slope is 35 feet, and between Omahu and Awatoto the slope is 66 feet.

Let us now consider the character of the plain which at present forms a portion of the bay known as Hawke's Bay, and situated between Napier and Cape Kidnappers, and which is covered by the sea. If a point is taken, out in the bay, 15 miles east by south of Napie , and about 8 miles to the north of the Kidnappers, it will enclose an area which is almost a counterpart of the Heretaunga Plain. The depth of the sea 15 miles from the Napier beach is 29 fathoms, or 174 feet; at 14 miles from the beach the depth is 28 fathoms; at 12 miles the depth is 24 fathoms; at 10 miles it is 18 fathoms; at 8 miles 15 fathoms; at 6 miles the depth is 12 fathoms; at 4 miles it is 10 fathoms; at 2 miles it is 8 fathoms; and at 1 mile the depth is 4 fathoms. Imagine for a moment the water taken from this portion of the bay, and there will be found an area of land as flat, and with a slope as gradual, as the Heretaunga Plain itself between Roy's Hill and Awatoto. This plain was formed in its greater part at the same time and under similar conditions as the Heretaunga Plain, and, geologically considered, it is a part of that plain. The shingle beach, which now forms such a characteristic feature along the coast between Napier and the Kidnappers, forms no part of the plain under consideration. Its history is limited to the period when the Tukituki broke through the limestones, marls, shingle, and pumice sands at Te Mata, and subsequent to the separation of Scinde Island from the mainland in the direction of the Quarantine Station. The shingle spit is limited both in breadth and depth, and began to be formed when a large portion of the present plain was above water level. It is not more than from 60 to 70 feet in depth, and its average breadth I estimate at less than 400 yards. If this beach were taken away, just as we have supposed the water in that portion of the bay between Napier and the Kidnappers to be taken away, there would be seen a valley plain, 30 miles long and from 8 to 10 miles broad, so flat, and so gradual in its slope, that the most perfect eye could not distinguish the inclination of the beds. I have pointed out that a mile or so to the west of Roy's Hill the plain is 166·4 feet above sea-level; whilst 15 miles out in the bay, or 30 miles from Roy's Hill, the sea is only 174 feet deep, or a difference of 340·4 feet between the highest and lowest points, with a gradual slope the whole way. This gives a fall of only 11¼ feet to the mile, or little more than a foot in each 480 feet of horizontality. Now these, to me very interesting facts, are of great importance in helping us to arrive at a proper conception with respect to the artesian water supply on the plain. Two or three miles outside the 15-mile limit in the bay the ocean bed is composed of blue clay. This clay is the underlying impervious bed which passes under the plain throughout its full extent. The same bed is met with about 2½ miles beyond Maraekakaho, where it is seen coming to the surface in the Maraekakaho Creek. At one time the sea washed over the whole length of this clay bed; but the sea has been slowly receding, in consequence of the débris brought down by rivers from the west, and deposited in what was once an arm of the present bay. All the beds which overlie this impervious clay-bed have been deposited in a constantly diminishing, or rather in a constantly-varying, thickness, as they get further and further from the source of supply, which, at the beginning of the plain formation, was the mouth of a large river then situated at Maraekakaho. It needs no explanation on my part to account for the constant thinning out of beds as they proceed from Maraekakaho outwards. Any observer can see the same thing happening daily, wherever water is removing débris and redepositing it under conditions where the movement is free. As remarked above, the lowest impervious bed is a blue clay of a somewhat irregular surface, having a north-east inclination, and troughed along its north-west and south-east edges. On this clay is to be found an overlying series of irregular beds composed of shingle, sand, impervious blue clays, blue sand, shingle, pumice, lignite, pumice and clays, shingle, pumice, fine mud, and sediment, in ascending order. All these have been brought down by the rivers and creeks which have at different times discharged themselves into what is now the Heretaunga Plain. These beds are not constant or identical in structure over the whole plain, nor should they be, considering the manner of their deposition; but for all that they are practically and geologically the same. In times of flood a river brings down vast quantities of materials, of various kinds and densities. These are not equally distributed over the area of deposition. Shingle may be in one place, pumice in another, sand or clay in another, and fine sediment in another, the deposits being modified as much by surface irregularities as by difference in the specific gravity of the materials brought down.

Bearing this in mind, let us now proceed to inquire as to the character of the artesian supply-wells in this district. Through the kindness of Mr. Garry, to whom I am much indebted for valuable information upon this point, I find that the character of the beds passed through when sinking in different parts of the district, varies greatly, in the 60 wells which Mr. Garry himself has sunk. Speaking generally, there is comparatively little alteration in the character of the beds between Napier and Pakowhai, but the beds in the direction of Redcliffe and West Clive vary much in character. So also do the wells vary in these places in depth, there being a marked diminution as compared with the depth of the wells in places like Pakowhai and Awatoto. But the change in the character of the beds and in the depth of the wells, whether in the direction of Clive and the Big Bush, or of Redcliffe and Taradale, is only what might have been anticipated at these places. They are at the points of the troughing of the underlying beds, and between which the water flowed when the Heretaunga Plain was an arm of the sea.

Commencing at Pakipaki, which, as already stated, is 82·89 feet above sea-level, artesian water is found at depths varying from 65 feet to 80 feet, or an average depth of say 70 feet, according to the point selected along the plain. This depth would give about 40 feet below sea-level, and 206 feet below the highest point taken near Roy's Hill. The depth corresponds to a point out in the bay, somewhat less than 2 miles to the south-east from the Napier beach. At the Pakipaki Hotel, water barely comes to the surface; and for this reason wells have been put down some distance further along the plain, so as to obtain a necessary flow. Near the railway-station, and at the Maori pa near by, I am informed that the water rises about 5 feet above the surface. At Pukahu, and at the railway crossing, Longland's Road, about midway between Pakipaki and Hastings, water is obtained at depths varying from 80 to 110 feet, or say 55 feet below sea-level, with a flow rising from 4 to 8 feet above the surface. The depth of the wells in these places corresponds to a point out in the ocean above

4 miles from the Napier beach. Hastings may be put down as being 40 feet above sea-level, and artesian water is obtained at depths varying from 130 feet to 160 feet, or say 100 feet below the sea, and 266 feet below the highest point on the plain. This depth corresponds to the depth of the ocean about 9 miles to the south-east from the Napier beach. Pakowhai is 18·47 feet above the sea, and artesian water is reached at depths varying from 140 feet to 170 feet, or say 137 feet below sea-level, and 303 feet below the highest point on the plain. This depth corresponds to the depth of the ocean between 11 and 12 miles out in the bay. Awatoto is 9·82 feet above sea-level, and water is reached at depths varying from 170 to 200 feet below the sea-level, and 340 feet below the highest point on the plain. This depth corresponds to the depth of the ocean about 15 miles out in the bay. At Napier, artesian water is found at depths varying from 180 feet to 240 feet, according to the proximity of the wells to the hills. This would give a mean of 210 feet below the sea-level, or 381 feet below the highest point on the plain. The flow at Napier in the best wells reaches a height of 80 feet or more. As we proceed from Napier or from Awatoto in the direction of Taradale, from Pakowhai in the direction of Redcliffe, from West Clive in the direction of the Grange and the Big Bush, and from Hastings in the direction of Omahu, the depth of the wells diminishes with the greatest regularity. Thus at Meanee the wells are 160 feet deep; at Roseneath, midway between Meanee and Taradale, they are 100 feet deep; whilst about Taradale they vary from 60 feet to 90 feet. At the Farndon Hotel the artesian well is 185 feet deep, at West Clive water is reached at 130 feet; at East Clive 90 feet; and at the Grange, and in the vicinity of the Big Bush, at depths varying from 60 to 85 feet. The variation at all these places exactly corresponds to what might have been expected from the troughing of the beds in these directions, as already pointed out. It will be observed that the increase in the depth of the beds from which the artesian water supply is obtained, as we proceed from Pakipaki to the sea in a north-east direction, corresponds in a striking manner to the slope of the plain between Roy's Hill and Awatoto, the slope of the plain being 166·4 feet, and the increase in the depth of the wells between Pakipaki and Awatoto being about 160 feet. To me this gradual deepening of the wells, as we proceed along the plain from Pakipaki in a north-north-east direction, is sufficient to prove that the whole of the artesian supply is obtained from the same shingle river-bed which passes underneath the plain, and gradually discharges its surplus waters on the floor of the ocean some 16 to 18 miles to the east of the Napier beach. But there is another important fact connected with the artesian supply which goes to support the theory that there is only a single

water-supply bed. At a short distance to the north-east of Pakipaki the artesian flow in the best wells is about 8 feet above the surface, which at this point is about 375 feet above sea-level. This gives an actual rise for the artesian wells at this place of about 48 feet above the sea. Hastings is about 40 feet above the sea, and the flow varies, so I am told, from 1 to 7 feet. Now the flow at the artesian well recently sunk at the Napier gas-works reaches a height above the surface of more than 80 feet, and I should imagine that the well is at least 6 feet above sea-level. This would give a flow of more than 86 feet above the sea. If we take into consideration the fact that the water, flowing as it does through shingle in its underground course, is much retarded by friction, I think that it will readily be conceded that there is sufficient to account for the small variation in the height of the artesian flow at places so widely apart as Pakipaki, Hastings, and Napier. I have no data as to the water supply between Omahu and Pakipaki, and between Pakipaki and Maraekakaho; but if my theory be correct, the question is not a difficult one to solve. It resolves itself into one of height. For example, the flow a short distance from Pakipaki is about 8 feet above the surface in the best wells, or between 40 and 50 feet above sea-level. Water may be expected and no doubt got anywhere on the plains within a few feet of this height. Of course water will be found on the higher parts of the plain, both in the direction of Omahu and Maraekakaho, but it will be by means of ground wells, which will vary in depth as they proceed along the plain in the direction of Roy's Hill. At the latter place the artesian water-bed ought to be reached or met with at a depth of about 120 feet, and near the Maori pa at Omahu water ought to be reached at a depth not exceeding 25 feet.

It is not possible to speak with any degree of certainty as to the actual character of the underground basin which supplies this district with such vast quantities of pure water, but for my own part I have no doubt whatever that it is an underground stream which moves slowly and steadily through the shingle-bed, which is bottled, as it were, within two impervious beds. This stream has flowed since the formation of the first beds on the plain, and the water has been discharged along the bed of the ocean far from the land. A curious fact in connection with the outflow is to be found in the effect of high tides upon the artesian flow near the sea-beach. I am informed that the difference in the height of the flow in the artesian wells in the vicinity of the sea-beach, as at Napier and Farndon, at high tide and low tide, varies as much as 2 feet. This fact goes to confirm my theory as to the outflow of the artesian supply-stream being far away in the ocean. The enormous amount of extra pressure upon the beds in the bay during high tides, and amounting to not less than 600 millions of tons, must cause a slight compression of the beds, and this would tend to keep back the fresh water from entering the ocean as freely as under a diminished pressure. This would result in a temporary accumulation in the direction of the point of outflow, which, with the increased pressure, would probably cause a higher flow to take place from the wells. A similar effect might be expected upon the artesian wells by the percolation of river water into the overlying beds on the plain, especially during times of flood. I believe that this increase in the artesian flow has been noticed about Hastings at the time of flooded rivers; and the natural inference has been that the artesian supply comes directly from the rivers Ngaruroro, Tukituki, and Tutaekuri by percolation through the shingle, as the rivers wend their way across the plain.

As for the origin of the water-supply, little can be stated with certainty. We know, however, that it cannot be by soakage through overlying beds, the one immediately overlying the shingle in which the water is found being impervious equally with the one underlying it. From this it follows that the rainfall on the Heretaunga Plain proper cannot affect the supply in any way whatever. It seems to me that the large quantity of water that is constantly passing underneath the plain, is to be accounted for by the presence of numerous under-ground springs at the junction of the limestones and the clays which underlie them, and by the percolation of river water through the shingle and sands at the *outcrop* of the beds. All the hills surrounding the district under notice are made up mostly of limestones, sands, clay, pumice sands, and shingle; and the same may be said of the rocks to the westward, even as far back as the eastern flanks of the Ruahine Mountain Range. All these rocks are exceedingly porous, and water passes through them most readily.

The limestones about Havelock, and the shingle conglomerates, clays, and pumice-sands at the Kidnappers, dip directly underneath the plain. So do the conglomerates and pumice-sands at Redcliffe, and so do the shingle and pumice deposits to the north-west of Maraekakaho; and we may expect to find large and important underground springs at the junction of these beds and the underlying clays. During my recent visit to the volcanic district of this island, one of the most remarkable sights, among the many remarkable ones to be seen, was the source of the Tokaanu River, which rises not a mile and a half from the southern shore of Lake Taupo, into which lake the said river discharges itself. At the base of one of the spurs of the now dormant volcano, Pihunga, a spring bursts from the ground, just after the manner of an artesian well, and the volume of water is so large that a river of no small size is at once formed as if by magic. The whole country around, both mountain and plain, is made up of porous rocks, and rain passes through them most readily, and must move in underground courses until forced to the surface by the filling and overflowing of some underground basin. Everything is favourable to the existence of similar springs at the junction of the pervious and impervious rocks in this district; and, if we add the quantity of water likely to percolate through the artesian shingle-bed along its line of outcrop, situated some distance to the west of Maraekakaho, we may easily account for the existence of that wonderful supply of pure well-filtered water which now passes underneath the plain, and which has proved of so much real worth from a sanitary point of view, as well to the people of Napier as to those residing in the surrounding district.

I append sections (Plates XVI. and XVII.) showing the inclination of the plain in various directions, also showing the depth of the ocean for a distance of 16 miles out in the bay. The deepening of the artesian bed is also shown between Pakipaki and Napier.

The sections fully illustrate the points referred to in this paper.

ART. XXXIX.—*Pumice: Its Geological Distribution on the East Coast of the North Island of New Zealand, extending from Tologa Bay* (38° 20′ S. lat.) *to Cape Turnagain* (40° 30′ S.).

BY H. HILL, B.A., F.G.S.

[*Read before the Hawke's Bay Philosophical Institute, 14th November,* 1887.]

Plate XVIII.

IN a short paper which I had the honour of reading before this Society last year, on "Traces of Volcanic Dust-Showers at Napier, and generally throughout the East Coast District,"* I mentioned, incidentally, that I had been engaged for some time past in collecting data as to the age and the extent of the pumice deposits so common throughout the district. I now beg to submit the results of my investigations as far as I have yet gone.

Pumice is a substance essentially volcanic in its origin, and is always more or less common in volcanic districts. It belongs to the class of volcanic rocks known as vitreous, as distinguished from crystalline, and to the sub-class acidic, as distinguished from basic. Rocks are said to be acidic when they contain as part of their constituent ingredients more than 60 per cent. of silica. When they contain less than 60 per cent. of silica they are said to be basic. According to Jukes, the following substances enter into the composition of pumice. The maximum, minimum, and mean percentage of each substance is given :—

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* "Trans. N.Z. Inst.," vol. xix., p. 385.

Substance.	Maximum percentage.	Minimum percentage.	Mean percentage.
Silica	77 ...	61 ...	68·1
Alumina	18 ...	10 ...	14·
Potash	6 ...	1·5 ...	3·7
Soda	11 ...	... ...	6
Magnesia	1 ...	... ...	·6
Oxide of Iron and Manganese ...	4·5 ...	0·5 ...	3.2

From this list of constituents it will be seen that, notwithstanding the generally supposed sterility of pumice, it contains in its composition every essential product needful for the making of what is known as a fertile soil. Indeed, I have often thought that a good deal might be said in support of the claims of pumice as being the origin, in this district at least, of most of the fertile soils. By far the greater portion of a mass of pumice is composed of silica and alumina, which, in a state of chemical combination, form clay. The same mass contains soda and magnesia, which form a part of every rich soil ; and the same mass also contains *potash*, which is essential to the fertility of all soil. Liebig, in his "Chemistry of Agriculture and Physiology," says that a Hessian acre of disintegrated felspar 20 inches deep contains 1,152,000 lbs. of potash. This would amount to 1,120,000 lbs. in an English acre 12 inches deep. Now in pumice there is about one-fourth the quantity of potash as there is in the same weight of felspar, so that in an acre of disintegrated or decomposed pumice 12 inches deep there must be something like a quarter of a million pounds of potash, whilst the quantity of soda in the same disintegrated mass would weigh nearly 400,000 lbs. The percentage composition of an orthoclase felspar, according to Rutley, is $S_i\,O_2 = 64{\cdot}20$, $Al_2\,O_3 = 18{\cdot}40$, $K_2\,O = 16{\cdot}95$. I am not aware of any special analytical tests having been made in New Zealand as to the composition of pumice, but I am inclined to the opinion that the pumice found throughout the East Coast of this Island contains less silica and more alumina than the amounts stated in the table quoted above.

Pumice, such as is to be met with in large quantities along the sea-beach of Hawke's Bay, is a light spongy-looking kind of rock which swims upon the surface of water. In reality, pumice is a porous or vesicular glass, closely allied in its composition to obsidian, and, in fact, it is found on the surface of obsidian lava-flows in volcanic districts generally. It must, not, however, be supposed that pumice is always to be found on the surface of lava-flows, or that it is only produced on the surface of such flows. There is sufficient evidence in the volcanic district of this island to show that such is not the case.

Pumice is usually of a dull grey, varying to a pale straw colour, although there are many places, both within and without the volcanic zone, where the pumice varies from a deep red to a pale salmon colour. The varieties, however, both in colour and composition are legion; in fact, a scale might be made of varieties of pumice, passing gradually from a beautiful white flour-like pumice, through coarse sand grit and boulder pumice, to a variety much resembling a trachyte, and thence to a kind of cross between a pumice and an obsidian. The numerous specimens on the table will fully illustrate this statement. Obsidian froth would perhaps best describe the pumice pebbles, such as are brought down from the pumice fields on the Taupo Plain by the Ngaruroro, Mohaka, and other rivers in time of flood, the composition of pumice and obsidian being almost identical. Although pumice appears to be so very light, its specific gravity is from two to two and a half times the weight of water. In other words, a cubic foot of pumice would weigh from 2,000 to 2,500 ounces. The beautiful specimen of obsidian which was found lately at the mouth of the Turanganui River, and which I have brought down for inspection by members, will give some idea as to the actual specific gravity of an apparently light substance like pumice.

As far as my own observations extend, no volcanic product is more widely diffused over the North Island of New Zealand than pumice and trachyte-pumice, which is a pumice containing small felspar crystals within its mass. The surface of the country within a radius of thirty miles or more of Lake Taupo is composed of nothing but pumice, underlaid for the most part by trachytic-lava rocks. Were I dealing with the character of the rocks found in the volcanic zone, as I hope to do at some future time, I should endeavour to account for the origin of the vast pumice deposits of that district; but my purpose in the present paper is to show how far the country to the eastward of the volcanic zone, and extending from the great central mountain chain forming the Ruahine, Kaimanawa, and Te Whiti Ranges to the sea, on the one hand, and from Tologa Bay (latitude 38° 20′ S.) to Cape Turnagain (latitude 40° 30′ S.), on the other, has been affected directly and indirectly by volcanic products in the shape of pumice and other ejectamenta. My second object is to trace the geological distribution of this important product.

The district named above may be said to contain an area of 5,000 square miles, and, as far as I am aware, there are only three places in the whole of this area where traces of igneous rocks are to be met with. These places are (1st) at

Tarawera, midway between Napier and Taupo, where the same trachytic-lava rocks are to be seen as are met with throughout the whole of the central volcanic district extending from the Paeroa Mountains to Runanga, a place situated on the Tarawera-Taupo Road. At the latter place the trachytic-lavas are seen to form the bed of the Waipunga Stream; (2nd) at Red Island, some miles along the coast to the south of Cape Kidnappers, where Mr. McKay ("Geological Reports, 1874–76," p. 45,) says igneous crystalline rocks occur; (3rd) at Woodville, in the Seventy-mile Bush, where a hard compact reddish rock, with a cellular and scoriaceous surface-structure is met with in a small creek which runs through the grounds adjoining the public school. The rock appears to be a variety of trachyte. Possibly other igneous rocks will be found as the country south by east and south-east of Tarawera becomes better known, where I imagine is the termination of the great lava stream which at one time occupied a large portion of the valley through which the Waipunga Stream and its numerous tributaries now flow. Indeed, I should not be surprised if the trachyte-lava rock is eventually found underlying the lowest beds of blue-clay marls which are to be met with in some places flanking the east slopes of the central mountain range, as in the Tukituki and Ngaruroro Rivers. But though the evidence of the existence of volcanic rocks is so very limited—and there are no traces whatever of eruptive vitreous rocks except at Tarawera and Woodville—the whole country bears the evidence of having been greatly modified even in its surface-features by volcanic products known as ejectamenta.

The geology of the district under notice has been in great part already described by the Geological Survey Department; Mr. Percy Smith, Assistant Surveyor-General, has also published a report in the "Transactions," vol. ix., p. 565, on the "Geology of the District between Napier and Mohaka." The results, though necessarily imperfect and incomplete, show that the district, though offering examples of Mesozoic and even of Palæozoic rocks, is essentially a Tertiary and Post-tertiary one, and offers ample testimony of vast movements, which have been brought about mainly by the action of water. According to the geological map published with the "New Zealand Handbook" by Dr. (now Sir James) Hector, the Director of the Geological Survey, a large proportion of the rocks exposed along the coast between Tologa Bay and Cape Turnagain belong to what are known in this country as the Cretaceo-tertiary formation. The older Tertiaries, known as Eocene and Miocene, are shown on the map to lie immediately to the west of the so-called Cretaceo-tertiaries, both to the south and north of Napier. Between Tiwhinui, a few miles to the south of the Mohaka River mouth, and Cape Kidnapper in the Hawke's Bay river system, the surface rocks belong to the later Tertiary or Pliocene and the Post-tertiary formations. These later deposits cover an enormous area inland, extending from Napier in a north-west direction beyond Pohui, on the Taupo Road, and in a west and south-west direction through the Heretaunga and Ruataniwha Plains, and thence onward and through the Seventy-mile Bush as far as the Manawatu Gorge. Similar rocks cover a large extent of country in the Poverty Bay District, and extend inland from Gisborne in a south-west direction as far as Te Kapu, near Wairoa or Clyde, although not so shown on the geological map. From specimens of fossils lately received from Mr. Balfour, sheep-farmer, who resides in the middle basin of the Mohaka River, it would seem that similar young rocks are largely developed in that district also; and hence a continuous belt of later Tertiary and Post-tertiary deposits can be traced through the East Coast District for a distance of nearly 200 miles. Westward, beyond the younger Tertiaries and Post-tertiaries, lie the Ruahine and other mountains of the central chain, the rocks of which belong to the older Mesozoic and Palæozoic formations. Now it is a curious circumstance that over by far the larger portion of the district under notice traces of pumice are to be met with, either upon the surface or immediately below the dark soil, which in a former paper I referred to as being partly of volcanic origin, and which covers a large part of the country in the Hawke's Bay District. This pumice is found as a surface-pumice equally upon the summit of the Ruahine Mountains as upon the Napier Hills, or upon the hills extending between Napier and Tologa Bay. Neither the surface irregularities nor the rock formations have made any difference in the distribution of the pumice over such a wide area. On the top of the Ruahine Mountains the pumice is in the form of large pebbles, such as are now to be found in immense deposits on the Kaingaroa Plain, in the Taupo District, and similar to those which are brought down and deposited along portions of the Napier beach by the Ngaruroro and other rivers. Much of the pumice underlying the surface-soil is of the character of grit, or coarse pumice-sand, although in many places the pumice is as fine as the finest flour, and as white as snow.

As far as I can gather, there are three very clearly defined periods of pumice deposition. These are:—

(*a.*) A surface or subsoil deposit of comparatively recent age, and referred to above as covering most of the country to the west, north-west, and north of Napier;
(*b.*) A Pliocene pumice deposit of vast extent and thickness, interbedded with shingle, clays, lignite, and fossiliferous sands;
(*c.*) A Cretaceo-tertiary? (Miocene) pumice deposit, found interbedded with the blue-clay marls.

First period.—Recent.—Surface or subsoil deposit.

As remarked above, this is a widely-spread deposit, covering the surface of the country over a large area. It can be traced continuously from Napier to Tarawera, and from Gisborne to Tarawera. At Napier and Gisborne it is a subsoil pumice, whilst at Tarawera it is a surface pumice. At Napier this pumice is seen to overlie pumiceous clays, and these in turn overlie pumice, scoriæ, and in places grit beds. These latter beds do not appear to belong to the higher pumice beds, which can be traced back as belonging to the surface pumice deposits met with at Tarawera, and thence onward to the Taupo Plain. I do not see how to account for the existence of this loose, coarse, sandy pumice, except on the supposition that at some period towards the close of the Post-tertiary deposits vast showers of pumice took place, which were succeeded by showers of volcanic dust not unlike those which took place at Tarawera in July last year. The small rounded pumice grits, which become larger and coarser as we proceed in the direction of the volcanic zone, show, by their shape, that they must have been subject to a large amount of attrition; and their peculiar position in the hill-sides goes to show that water had nothing whatever to do in their deposition. The entire district between Napier and Poverty Bay is more or less covered with this characteristic deposit, which is overlaid by a very thin coating of dark black soil.

Second period.—Pliocene.—A pumice deposit, associated with shingle, conglomerates, sands, blue clays, and lignite.

This is a very remarkable deposit, and characterises the period as one of vast movements brought about mainly by the action of fresh water. The beds forming the southern shore of Hawke's Bay, and extending from what is locally known as the Black Reef, 2 miles or so within Cape Kidnappers, to Havelock, and thence onward to Pakipaki, are the typical representation of the pumice deposits of this period. The beds composing this very interesting section must be, at the very least, from 1,500 to 2,000 feet in thickness, for they extend in a most regular manner for several miles as high cliffs, dipping to the W.N.W. at an angle of about six degrees. The pumice alternates in these beds with shingle, clays, blue and straw-coloured sands, conglomerate and lignite, and, including the different beds, the pumice must amount to several hundred feet in thickness. The pumice varies in character in the different beds, from pebbles two or more inches in diameter, to a very fine deposit somewhat resembling chalk, and of a beautiful whiteness. In some of the pumice beds fine specimens of fossil leaves are met with, and these are as perfect in structure as if just gathered from a tree, their black shiny carbonized surfaces being the only distinction between them and freshly-gathered leaves. Every vein and veinlet are seen, but their beauty soon fades when their surfaces are exposed to the air. Many specimens of fossil leaves are also to be met with in the lignite beds, which are found in the lower part of the section. With the kindly help of Mr. Hamilton, our Secretary, I have been able to obtain some fair drawings of a few of the leaves found by me, and also of some from the pumice beds of the Poverty Bay District.

The pumice deposits, of what I have ventured to name the Kidnapper section, pass underneath the Heretaunga Plain, and they re-appear again at the back of Maraekakaho. At Redcliffe, near Taradale, six miles from Napier, the Kidnapper beds are largely developed, the pumice beds being underlaid and overlaid by conglomerate beds of a deep-red colour. These pumice and conglomerate beds are seen to dip to the E. by S. underneath the bed of the Tutaekuri River, in the direction of the Kidnappers. In the Redcliffe pumice deposits a ruby-kind of quartzite is found embedded here and there, and some mica scales are met with at the junction of the pumice and conglomerate beds. From Maraekakaho, both north, west, and south-west, the pumice deposits have an enormous development. In the direction of Hampden and the Ruataniwha Plain they cover the entire district, all the hills being composed of pumice and shingle, alternated here and there with clays and an impure lignite bed. The hills forming the watershed between Maraekakaho and Hampden, and which run southward along the east side of the Ruataniwha Plain, opposite the Guavas station and Hampden, and forming the left bank of the Manga-o-nuku Stream, are composed of pumice, shingle, clays, blue sands having a tinge of green, and lignite. These deposits correspond to the Kidnapper middle and lower beds. These pumice beds are seen to pass underneath the Ruataniwha Plain near the Guavas station, and they are again met with in the Tukituki River, on the west side of the plain, just below the crossing leading from Te Onga-onga to Makaretu. The beds at this point are dipping to the south-east. Six miles further up the river the pumice beds are again exposed, dipping south-east, and having their strike in the direction of Ashley-Clinton. At this place the pumice and conglomerate beds form the tops of the highest hills in the district. The pumice is fine in texture, but is underlaid by coarser pumice-sands and pebbles, intermixed with angular sandstone grit. About nine miles further to the south by west, is the Scandinavian settlement known as Norsewood. The height of this township is something like 1,800 feet above sea-level, and until taken up for special settlement purposes the district formed a part of the Seventy-mile Bush. Here shingle lies immediately underneath a poor soil, and below the shingle come the characteristic conglomerate and pumice beds of the Kidnapper section. The lignite bed is also met with, it being exposed in most of the creeks in the whole of the bush district. In one exposure, between Norsewood and the hills which flank the Ruahine Mountains, the lignite is exposed for a thickness of 20 feet, but it is perfectly useless for domestic purposes. Between Norsewood and Dannevirke the same pumice and attendant beds are to be met with in every exposure by the wayside, and it would appear as if the whole of the district,—from the lower hills flanking the spurs of the Ruahine mountains to the limestones and marls which pass down the left bank of the Manawatu River,—was simply an extension of the Kidnapper pumice section. I have followed portions of these pumice beds as far as the Manawatu Gorge, where the shingle conglomerate and pumice are met with overlying limestones, as is the case in so many other places. The pumice deposits to the west, north-west, and north of Maraekakaho all belong to the Kidnapper section. They can be traced from Maraekakaho to Kereru, thence to Pohui, Te Kapu, Murumuru, Te Reinga, and onwards to Poverty Bay, where they form the lower slopes of all the hills to the east, north, and north-west of Gisborne township. In the Poverty Bay pumice beds the shingle is not so largely developed as in the district further south, but fine specimens of fossil leaves are obtainable from the white pumice beds. The leaves are quite unlike those found in the Kidnapper beds already referred to. They are of smaller size, and most of them appear to be similar to leaves which may now be found growing in the higher and more elevated lands of this island.

Up to the present time I have found 44 varieties of fossil leaves in the Poverty Bay beds, and two specimens of lycopods. In the lignite beds of this district fossil ferns are abundant; but I have not yet been able to spare time to make a collection, such as I hope to do shortly. In the "New Zealand Guide to the Geological Exhibits at the Indian and Colonial Exhibition," published last year, Sir James Hector, in his classification of the rocks constituting the Pliocene formation, places the pumice and conglomerate beds just described below what are known as the Napier or Scinde Island limestones. The classification made by the Geological Department of the Pliocene rocks, in descending order, is as follows:—

(*a*.) Dispersed gravels;
(*b*.) Napier series (limestones and marls);
(*c*.) Lignite series;
(*d*.) Kereru series.

These several series are followed by the Te Aute series, which the Geological Department places at the top, or among the highest beds of the Miocene formation. In the "New Zealand Handbook," also published by Sir James Hector, page 26, the classification of the Pliocene formation is somewhat different from the above, the Scinde Island limestones being placed with

Terrace plains, as the youngest of the Pliocene series. According to this classification, the pumice deposits of what I have termed the second period of deposition, as described above, are considered as being older—indeed, much older—than the Napier limestones and marls. The official classification has evidently been based upon the report furnished by Mr. McKay, the Assistant Geologist, who, in his report on the "Geology of the District between Napier and Waipukurau,"[*] says: "Lying in the low grounds to the west of Shrimpton's, and forming the strata underneath the river-gravels of the Ngaruroro Plains, is a great development of sands and gravels with beds of clear white pumice sand. All these strata dip in an easterly direction, and apparently pass underneath the marly strata and Scinde Island beds forming the hills to the east." For my part, I do not see my way to accept the classification of the Geological Department in relation to the pumice beds and the Scinde Island limestones; in fact, the evidence to me is overwhelming in favour of the following classification:—

Pliocene formation, in descending order,—
(*a.*) Dispersed gravels;
(*b.*) Pumice, conglomerates, blue clays, and lignites;
(*c.*) Kereru *Rotella* crags and fossiliferous sands;
(*d.*) Scinde Island lower limestones, the upper limestones being the equivalents of the Kereru crags.

So as to test the question fairly, every section for many miles round about Napier has been gone over by me, and I have followed the pumice beds of the Kidnapper section past Havelock, Pakipaki, Maraekakaho, thence south-west up the Maraekakaho Stream, and down the Manga-o-nuku Stream as far as the Waipawa-Hampden Bridge; and in no single instance is limestone of any kind to be found overlying pumice beds, but there are many examples of pumice and conglomerates overlying limestones. I have also traced the Kidnapper pumice beds in a N.N.W. direction as far as Pohui, thence N.E. through a large portion of the Cook County; and in no single instance in this direction have I seen pumice, or any of the beds representing the Kidnapper pumice section, underlying limestone. Everywhere the evidence shows pumice, shingle, clays, etc., overlying limestones—as for example, at Napier, at the Black Reef in the Kidnapper section, at Petane, Tongoio, Roy's Hill, Pakipaki, Maraekakaho, Te Reinga, Poverty Bay, and many other places. In one of the Geological Reports issued by the Department, it is stated that pumice is to be found inter-bedded with the Scinde Island limestones, and that pumice is met with at Pukotapu underlying the limestones. I have not yet been able to find either of the beds referred to, or even traces of them.

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[*] "Geological Reports," 1879.

On the Napier Hills, lying unconformably on the upper limestones or the marls, large deposits of pumice, pumiceous clays, scoriæ, and in some places grits, are to be seen. At the Breakwater Point the pumiceous deposits must be quite 35 feet in thickness, and on the north-east side of the Napier Hills the beds are even of greater thickness. At Puketapu, where pumice is said to underlie limestone, there is a large development of conglomerate and pumice; and the beds composed of these materials can be well seen resting on the Napier marls on the roadside near Alexander's, on the Puketapu-Petane Road; whilst a little further on, in the direction of Puketapu, the limestones (Napier upper) are met with overlying the same marls; that is, on the denuded surface of the marls are to be seen pumice and shingle, whilst on the undenuded marls rest the limestones. Now, are the Napier lower pumice and pumiceous clay deposits and the Puketapu shingle and pumice deposits to be classed as belonging to a period much later than the pumice beds of the Kidnapper section, or are they to be classed as belonging to the Kidnapper section? If to the latter, then it is clear that the classification of the Geological Department is a wrong one; and if to the former, then it must follow that the Napier limestones are simply a part of the Kidnapper pumice section, having pumice, shingle, and conglomerates below them, and pumice and conglomerates above them; but, as far as I can find, there is not a particle of evidence in support of such a classification. If the Kidnapper pumice section is older, as the Geological Department say it is, than the Napier limestones, it follows that the Napier pumiceous clay beds belong to a period corresponding in point of time to the "dispersed gravel series," or to a more recent period still—that is, to Post-tertiary times. But such an arrangement cannot be supported by a tittle of evidence. As already remarked, every section and every exposure, as far as I have any acquaintance of the district, supply facts showing the pumice, gravels, sands, conglomerates, and lignites of the Kidnapper section as overlying the Scinde Island limestones, and that the Napier pumice beds form a part of that section. In contending here for the greater age of the Scinde Island limestones, as compared with the pumice deposits, I do not desire it to be understood that the limestones upon which the pumice and included beds are seen to rest are all of the same age, for the contrary is the fact. My contention is simply that the Kidnapper pumice section, which is so largely represented throughout the East Coast District, is not below but above the Scinde Island limestone; and that the pumice deposits, as represented by the Kidnapper, Scinde Island, and other beds, are the youngest of the Pliocene series, with the exception of "dispersed gravels."

The height of the pumice deposits in the localities named above varies considerably. In the Kidnapper section itself the highest beds are nearly 400 feet above sea-level. In Napier the highest beds exceed 300 feet in height; whilst at Redcliffe, near Taradale, the highest pumice bed met with is not more than 150 feet above sea-level. Behind Maraekakaho, and midway between it and Hampden, the pumice is found at a height of about 1,000 feet, and this height is maintained along the eastern and western sides of the Ruataniwha Plain, and thence onward to Norsewood. The pumice and shingle deposits in the Poverty Bay District, in the immediate vicinity of Gisborne, are not less than 750 feet in height. It would seem as if the area now forming the Ruataniwha, Heretaunga, and Poverty Bay plains—and, indeed, the entire country eastward of the great axial ranges of the island, was, towards the close of the Pliocene period, simply one vast surface-deposit of pumice, shingle, lignite, and blue (volcanic) clays, of great depth; that the sea-shore was much farther to the eastward than it now is; that the beds of the rivers flowing at that time from the west were hundreds of feet higher than they now are; and that aërial and aqueous agencies, operating throughout a long period of time, have brought about the lowering of river-beds, the formation of Post-pliocene plains and valleys, and the disappearance of a large area of land to the east of the present coast-line. Of the changes produced on the land, as indicated above, the facts are patent to every observer, and that the land was once greatly extended eastward of the present coast-line must also be evident to those who, like myself, have travelled for any length of time along the coast. Wherever the blue-clay marls are exposed, denudation proceeds at a surprisingly rapid rate. In some places whole hill-sides are now moving seawards—as at Waimarama, Mohaka, Poverty Bay, and other places further north; and the numerous extended reefs which are exposed almost everywhere along the coast at low water show that this process of coast denudation has been going on for a long time past.

I do not know whether the time is near or distant when geologists will be able to study the geology of places along the same parallels of latitude both to the north and to the south of the equator; but it seems to me that a good deal might be learnt of the physical and cosmical earth-changes from this mode of study. In concluding my account of the second period of pumice distribution in this district, I venture to make an extract from Charles Darwin's description of the northern portion of Patagonia, as given in the "Voyage of the *Beagle*." Mr. Darwin's description of the Pliocene rocks of Northern Patagonia, in the corresponding latitude as the Pliocene deposits of Hawke's Bay, agrees in a striking manner with the deposits as found in this district—indeed, the description of certain beds found by him in his exploration of Northern Patagonia might almost be used to describe some of the beds belonging to what I have described as the Kidnapper pumice section. His words are:—"These beds are covered by others of a peculiar *white stone*, including much gypsum, and resembling chalk, but really of a *pumiceous nature*. These white beds are everywhere capped by a mass of gravel, forming probably one of the largest beds of shingle in the world." • • • "Yet all this gravel has been transported, and probably rounded, subsequently to the deposition of the *white beds*, and long subsequently to the underlying beds with the tertiary shells."

I ought to have mentioned that the Moa footprints which may be found at the mouth of the Turanganui River at Poverty Bay, at low water, are in the pumice deposits, which are largely exposed at this place. Footprints of birds were also found in the pumice beds on the Napier Hills, when the fresh water reservoir was being dug out at the corner of Lighthouse Road.

Third period.—Cretacco-tertiary ' (Miocene).—A pumice deposit, interbedded with blue marls.

This, I suppose, must be called the Cretaceo-tertiary pumice deposit, because in each place, with a single exception, where the pumice is found the rocks are classed as Cretaceo-tertiary by the Geological Department. No mention is made, as far as I know, in any of the geological reports of the existence of a *pumice* deposit among the Cretaceo-tertiary rocks; but there can be no doubt as to the existence of such—that is, if the classification made by the Geological Department be a correct one. Commencing at Tologa Bay, at the most northerly point of the district dealt with, the blue marls and clays running along the northern shore of the bay are described (in "Geological Report, 1887," page 152,) as belonging to the Cretaceo-tertiary formation. The cliffs at this place rise to a height of about 150 feet, and they dip to the north-west at an angle of about five degrees. Interbedded with the blue clays and marls is a band of somewhat coarse pumice-sand, which varies in thickness from 2 feet to 8 feet. Overlying the pumice band the rocks appear to have scattered through their mass large pumice grits, as if the clays and pumice-sands had been mixed together by the action of water. This is characteristic of many of the blue rocks which are exposed between Tologa Bay and the Mahia Peninsula. In some places the pumice is of the size of large pebbles. As regards the pumice band itself, it is continuous throughout the whole extent of the exposed beds. About 10 miles to the south of Tologa Bay there is a place on the coast known as "Hole in the Wall." It is so called from a small archway formed in the rocks by sea-action, and subsequently enlarged as a roadway to avoid a somewhat dangerous beach. Here a pumice band again appears, similar to that seen at Tologa Bay. The rocks dip to the N.E., and the pumice band, which is nearly 3 feet in thickness, is quite conformable to the underlying and overlying blue marls and clays. In this pumice band I found a single ovoid pebble 5 inches long, 3 inches wide, and about 1½ thick. It is evidently a volcanic bomb. In the Geological Report referred to above, it is stated that at the "Hole in the Wall" are calcareous marls, between which is a "grit bed forming the roof of the archway." The grit referred to is pure pumice, and could not be distinguished from bedded pumice in the Taupo District. The rocks at this place are classed by the Geological Department as belonging to the Cretaceo-tertiary formation. On the south side of Poverty Bay is the cape known as Young Nick's Head—the first land named in New Zealand by Captain Cook. The rocks forming the cape are identical, both in character and fossils, to the Tologa Bay beds, except that, instead of one pumice band, two pumice bands are met with, the upper one being less pure than the lower one. The rock immediately overlying the upper band is very fossiliferous, Foraminifera being abundant. At the mouth of the Mohaka River, which empties itself into Hawke's Bay to the north of Napier, the blue-clay marls are largely exposed. These marls are also classed by the Geological Department as Cretaceo-tertiary. Interbedded with the marls is a pumice band of from 10 to 15 inches in thickness, and it is constant wherever exposed. This pumice band is of the same colour as the overlying beds, and on its upper surface numerous fossil Foraminifera are met with. The rocks at this place dip to the south-east at an angle of about eight degrees. Cape Kidnappers, which forms the southern boundary of Hawke's Bay, is shown on the geological map as belonging to the Cretaceo-tertiary formation; and a similar pumice band of about 15 inches is seen exposed near to the most eastern point of the cape. It is interbedded conformably with the underlying marls, and dips to the west by north at an angle of about five degrees. Further evidence of the general diffusion of a pumice band through so-called Cretaceo-tertiary rocks is to be found inland between Poverty Bay and Wairoa, at Ahi-manu, Te Kapu, and other places. The pumice bands, three in number at the former place, are at least 1,200 feet above the sea-level. At Porongahau, also, in the direction of Cape Turnagain, the pumice band is met with in similar rocks to those exposed in so many places along the coast. Of the general diffusion of a pumice band among rocks of a much older date than the later Pliocene there can be no doubt whatever, as the foregoing facts go to prove; but I am of the opinion that these so-called Cretaceo-tertiary rocks are younger than the official classification would make them. For my part, I am inclined to place them intermediate between the Eocene and Miocene, and I think the fossils found in the series will bear out this classification. How the pumice band came to be deposited among marl-clays over such a vast area, and quite conformably to the underlying and overlying beds, I am at a loss to explain. I venture, however, to offer a suggestion. Are the blue-clays so common throughout the district simply volcanic ejectamenta, which have been subsequently acted on by aqueous agencies? I am inclined to think so. The blue-grey mud ejected from Rotomahana Lake at the time of the Tarawera eruption, last year, bears a close resemblance to the blue marl-clays in which the pumice band is found. Those who have been over the volcanic district of this island will readily understand that the eruption of mud from Rotomahana is only one of many similar eruptions which have taken place. Hot-water action and steam have played in the past, as they still play, an important part in what is understood as volcanic phenomena. The mixture of clay and pumice-grit and pebbles, of which such a large proportion of the rocks between Mahia and Tologa Bay are seen to be composed, suggests an inquiry as to how a mixture of this sort came about. Clay, equally with pumice, must be set down as a volcanic product; and I see no way to account for a conformity between the pumice and clays, except on some such supposition as stated above. The *moya* of the Central and South Amerian volcanoes is the mud of the Tarawera eruption; and we may suppose that eruptions of mud have been no uncommon event in the history of volcanic phenomena in this island. At least, such is my opinion, and such is the suggestion I offer, as accounting for the pumice band found in the rocks of this East Coast District, and which are classed by the Geological Department as belonging to the Cretaceo-tertiary formation.

The accompanying map (Plate XVIII.) contains all the places mentioned in this paper.

Art. XL.—*Notes on the Volcanic Rocks of the Taupo District and King Country.*

By Professor A. P. W. Thomas, M.A., F.L.S.

[*Read before the Auckland Institute, 14th November, 1887.*]

Mr. Cussen has requested me to identify for him a large number of rock specimens collected during his stay in the Taupo District and the King Country; and the present notes are intended to illustrate the more interesting points in connection with some of them.

Hochstetter travelled through the Taupo District in April, 1859, but his time there was limited, and gave little leisure for the exploration of the country. He states that all the volcanic rocks collected by him belonged to the family of rhyolites. The rhyolites are a group of lavas which present themselves in an immense variety of structure: they are characterised by the large proportion of silica which they contain, generally so large that the excess separates out in the form of free quartz.

The rocks collected by Mr. Cussen show, however, that a more basic group of lavas, with a lower proportion of silica, are abundantly represented in the Taupo District. The more recent lavas of the giant volcanoes Ruapehu, Ngauruhoe, and probably Tongariro, appear to consist of the basic rocks known as augite-andesites. These are richer in metallic bases and poorer in silica than the rhyolites.

Up to the time of the eruption of Tarawera, in June, 1886, basic rocks were not known to occur in the Taupo volcanic zone.* I have shown elsewhere that the lava of the Tarawera eruption was a form of augite-andesite, and that the same rock occurs at Mount Edgecumbe, the volcanic cone lying 15 miles north-east of Tarawera and in the direction of the Bay of Plenty. It is interesting to find that the same rocks occur as the most recent lavas on the great cones in the south of the zone, and that at so many points along the main line of activity the succession of volcanic rocks has been the same—basic augite-andesite succeeding the acid rhyolites. The country around Lake Taupo is remarkable for the vast quantities of pumice which form the superficial deposits; but it is stated by Mr. Cussen that on approaching Ruapehu and Tongariro the pumice becomes less abundant, and that the surface is formed by a layer of dark brown loam, which is more fertile than is usually the case with the soil of this region. That this is the case is shown by the establishment of sheep-runs near Tongariro. The richer character of the soil appears to be due to its origin from the decomposition of andesitic ashes from the more recent eruptions of the mountains. Speaking generally, the ashes of basic rocks such as the augite-andesites, or basalts, yield by their decomposition a richer, more fertile soil than the acid rocks.

As is well known, the order of succession of the rocks at any given vent, or in a given volcanic district, is such that the more basic follow the acid lavas. The appearance of the basic lavas at such different points in the Taupo zone seems to indicate the opening of a new phase of its volcanic activity, this present stage being characterised by basic lavas. There seems, therefore, a probability that, if the country in the Taupo volcanic zone is ever again covered with great showers of ashes like those which recently fell at the eruption of Tarawera, those ashes will, as they decay, yield a richer soil than barren pumice, now covering so large an area.

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* Hochstetter, however, in "The Voyage of the *Novara*" (Geology: vol. i., p. 104), states that he saw in the Museum of the School of Mines, London, basalts which were said to be from White Island.

Augite-andesites.—The most interesting of these rocks are undoubtedly those which occur at the great volcanic cones to the south of Lake Taupo. The most recent lava stream on Ngauruhoe, said to be that of the eruption of 1869, is a black scoriaceous rock of somewhat resinous lustre. A fresh fracture shows to the naked eye small crystals of white felspar and dark augite. Thin sections for the microscope show that the rock contains numerous crystals of felspar and augite, which measure up to ·16 inch in diameter; but olivine is wholly absent. The felspars are almost entirely plagioclases, but one or two sanidines can be detected. The former are remarkably rich in inclusions of brown glass, sometimes so numerous as to obscure all the clear substance of the felspar, except a narrow rim which is free from inclusions. In some crystals all the glass of the inclusions is devitrified by the appearance of globulites; in others the glass is still pure. Sometimes the inclusions are arranged in zones, showing the stages of growth of the felspar crystal. A few felspars contained numerous vapour cavities, and augite grains, in addition to the glass. The augite crystals also contain glass inclusions, but they are far freer from them than the felspar. The ground-mass of the rock is a yellowish-brown glass, containing microliths. The glass is abundant, and the microliths of all stages of development, but most of them whilst appearing as simple rods are sufficiently large to polarise slightly. The ground-mass also contains a few grains of magnetite.

Other specimens from Ngauruhoe belong to the same type of rock. In one of these the glass of the ground-mass is colourless, but contains a fine black dust, which renders the ground-mass very dark, except in extremely thin sections. The glass inclusions of the felspar crystals, however, are many of them of the same brownish colour as in the previous rock, showing that the glass was originally of the same colour in both rocks. A rock obtained from a considerable altitude on the western slope of Ruapehu is nearly of the same variety; the ground-mass of the rock, however, is more finely microlithic.

Other augite-andesites were obtained from near the crossing of the Whanganui River, a stream flowing into the west side of Lake Taupo. In one of these the ground-mass was composed of microliths, cemented by a very small amount of colourless glass. It remained dark between crossed nicols, save for a few small crystals of felspar and augite, and some scattered microliths sufficiently developed to polarise. In another variety no glass could be detected in the microlithic base, but it included a considerable number of felspars, augite grains, and magnetites. An augite-andesite from Whangamata Bay has a ground-mass intermediate between the last two varieties.

Near the Karutau Stream, on the west of Lake Taupo, was found a very black rock of resinous lustre, and showing only a few small crystals to the naked eye. The microscope shows that the larger crystals—the first separated in the cooling of the rock—are principally plagioclases, though a few augites are present. The plagioclases have very numerous inclusions of glass, which is sometimes brownish, but usually greyish and partly devitrified. The ground-mass consists of a grey glass, containing numerous microliths and magnetite grains; but here and there patches of brownish glass, free from microliths, are to be seen. It contains, also, numerous ledge-shaped sections of small plagioclase, which show a flow-structure by their arrangement.

The curious peak of rock on the summit of Titiraupenga, which forms so conspicuous a landmark when viewed from the country north of Taupo, is composed of a rock which must be considered as an augite-andesite. It is a rock of interesting appearance, having a dark-grey ground-mass, in which are embedded abundant greenish-black augite crystals, measuring up to ⅓rd of an inch in diameter, and more numerous felspars up to ⅛th of an inch in diameter. There is no olivine. The felspars are chiefly plagioclases; they are much fissured, and have fairly abundant glass inclusions. The augites have very few inclusions, their borders in some cases being sharply defined, but, as a rule, they are bordered by a single row of crystalline augite grains, which form, as it were, the outermost layer, or zone, of the crystals. The ground-mass is distinctly micro-crystalline, being composed of augite grains, felspar, and magnetite, with only a small proportion of amorphous matter between.

It should, perhaps, be mentioned that augite-andesites were found by Hochstetter in the country lying further to the north-east of Lake Taupo—as, for instance, at Kakepuku and Pirongia, extinct volcanic mountains lying on the right and left banks respectively of the Waipa.

Rocks collected by Mr. Cussen at Maungakawa are also augite-andesites.

Rhyolites.—The rhyolites occur in a greater variety of structural forms than perhaps any other species of rocks. Some of the varieties are eminently glassy (forms of obsidian, pumice, etc.). Another group—the Rhyolites proper of Zirkel, but named by v. Richthofen and others the Liparites—includes felsitic and porphyritic varieties. Both these groups are represented by numerous varieties in the Taupo District. A third group, the Nevadites or granitic rhyolites of v. Richthofen, appear to the naked eye to consist mainly or entirely of crystals of quartz, sanidine, etc., the ground-mass being present in small quantity. This last group is not represented in the district, so far as I am aware.

Very numerous specimens of rhyolites were collected by Mr. Cussen, more especially on the western side of the lake. I do not propose to deal with all the varieties found, but merely to mention some of the leading forms.

A rhyolite from Whangamata Bay has a distinctly granitoid appearance, showing numerous white crystals, with angular granules of darker substance between. A little closer observation, however, suffices to show that the darker portions are merely the ground-mass of a dark-grey glass in which the crystals are embedded. The latter consist of cracked glassy blebs of quartz and sanidines, with some plagioclase. The rock contains, besides, a few small augites. The ground-mass is a nearly pure glass, alternating with a glass densely crowded with long slender pellucid microliths which do not polarise. The alternation of bands of these two varieties of glass in wavy lines makes evident the fluidal structure of the rock.

Another rock from the same locality is grey in colour, the macroscopic crystals are few in number; they are mostly sanidines, with a smaller proportion of plagioclase. Quartz seems to be absent, and the rock contains accessory crystals of dark-brown hornblende and pale augite; both are scarce. It may be added that augite, in small amount and in small crystals, is a very frequent mineral in the rhyolites of the neighbourhood of Lake Taupo; in other parts of the Taupo zone I have found it much less frequently. The ground-mass in the rock is sphærolitic, consisting of granules, and greyish non-polarising granules, arranged in small spherical masses, the fibres radiating from the centre of the spheres. In this case the sphærolites show no tendency to separate from one another, and are not visible to the naked eye.

A grey rock from the same place contains a large number of macroscopic crystals, mostly quartz and sanidine, with a considerable proportion of sanidine; but both hornblende and augite are present in very small amount. The ground-mass is microfelsitic, with a strong tendency to form axiolites in which the fibrous material diverges, not from a point as in the sphærolites, but from along a line or axis. It may be noted here, that, whilst in the typical rhyolites the orthoclase felspars (sanidines) predominate, plagioclase being present in much smaller proportion, yet in some of the varieties of the Taupo volcanic zone the proportion of plagioclase rises occasionally so as to equal that of the sanidine, and, possibly, surpass it, suggesting the idea that the rock is a dacite. Nevertheless, on the whole, the sanidine exceeds the plagioclase in amount in these rocks.

A rhyolite from Western Bay has a ground-mass which is a mixture of wavy fluidal bands and streaks of lilac and bluish-black stony substance. The crystals contained in the ground-mass are mainly sanidines, quartz is absent, and plagioclase and augite are present in small quantity. The ground-mass is partly micro-felsitic, and consists of dark bands of micro-felsite which alternate with bands, clearer bands, in which the micro-felsitic matter passes into a finely micro-crystalline aggregate with red granules.

The rock which forms the island of Motutaiko is a bluish-grey laminated lava, with semi-vitreous glaze along the surface of the joints. The thin parallel laminæ of which the rock is composed are often very distinct, and are alternately more or less glassy, but in other parts the laminæ blend together, as the glass becomes more fully devitrified. The macroscopic crystals are not numerous, and are chiefly sanidines; plagioclase is, however, also present, as well as augite, magnetite, and apatite. The ground-mass is chiefly a pale-glass, crowded with slender microliths and black granules, but it is marked here and there by dark-brownish patches and streaks of indefinitely granular or micro-felsitic matter, giving a banded character to the rock.

It is unnecessary to mention here the pumice, which occurs in such vast quantities in the district. A nearly pure obsidian was obtained by Mr. Cussen on Ngauruhoe. It has a perfect conchoidal fracture, and no macroscopic crystals. In thin flakes it shows a greenish-smoky colour and bands of a darker shade. The general mass of the rock is quite free from microliths, but the bands derive their darker appearance from the presence of multitudes of parallel microliths.

ART. XLI.—*Notes on the Rocks of the Kermadec Islands.*

By A. P. W. THOMAS, M.A., F.L.S., Professor of Natural Science in the Auckland University College.

[*Read before the Auckland Institute, 14th November,* 1887.]

THE following notes are descriptive of the various rocks collected by Mr. Percy Smith during the recent visit of the *Stella* to the Kermadec Islands. Most of the specimens were obtained from Sunday Island, the largest of the group.

The rocks, with one curious exception, are unmistakably of volcanic origin, and consist of fragmental materials in the form of scoriæ and fragments from the tuffs, and of lavas from the streams which alternate with the tuffs, or from the dykes which intersect the islands, and bind the loose beds and lava streams together.

The lavas are of a basic character, and consist of basalt and augite-andesite, together with glassy varieties of basic rocks.

Basalt.—One of the most characteristic types occurs in a stream on the east coast of Sunday Island. It is a dark porous rock in which the larger crystals can just be seen with the naked eye. In microscopic sections these are seen to consist of numerous plagioclases and olivines, with yellowish-green augites. The plagioclases are in slender prisms, and seldom show any inclusions. The ground-mass of the rock is very finely crystalline, and is composed of felspar, crippled augite grains and crystals, and minutely octahedral magnetite. No amorphous matter can be distinguished between the elements of the base. The magnetite is so abundant as to render the ground-mass very dark, and the crystals are frequently grouped along lines at right angles to one another, so as to form the most beautiful branched figures.

The recent lava from the Cascade, in Macaulay Island, differs considerably in its macroscopic crystals. These consist chiefly of plagioclases reaching 0·25 inch in diameter, which, in striking contrast to those in the former variety, are in short stout crystals, showing a zonal structure, from the abundance of the inclusions of glassy matter. These inclusions are often accurately rectangular, their longer sides being parallel to the neighbouring face of the crystal. Even the minutest inclusions, which occur in such abundance as to appear under a low power like dusky clouds, generally show this rectangular form. The only other crystals which reach any considerable size are a small number of olivines, containing magnetites. The ground-mass is much like that of the rock first described, the magnetite, however, though equally abundant, does not form the branched groups of crystals.

The scoriæ from the recent crater on Macaulay Island are also basaltic, differing chiefly from the lava at the Cascade in containing a good many augites of the first order of separation. Another basalt which occurs on the east coast of Sunday Island is rich in olivine crystals, and has a ground-mass of more coarsely crystalline granular structure. The large macroscopic plagioclases have numerous inclusions of brown glass, often arranged in long streaks alternating with the lamellæ of the crystals.

The common grey lava from the north coast of Sunday Island has a rather light-grey and finely crystalline ground-mass, in whch small augites and felspars can be seen with the naked eye. The felspars seem to be all plagioclases, and are fairly rich in glass inclusions. The rock contains no olivine, but must be considered as a basalt, as the ground-mass is of a distinctly basaltic type, consisting of a crystalline aggregate of plagioclase, augite, and not very abundant magnetite, the individual elements being unusually distinct. No glass can be recognised with certainty in the ground-mass.

A somewhat similar rock, which occurs as a dyke on Meyer Island, an outlying part of Sunday Island, has a darker-grey ground-mass in which augite cannot be seen with the naked eye. The microscope shows a few augite crystals of moderate size, but there is no olivine. The ground-mass is more finely-grained than in the previous rock, and small patches of pale glass can be detected. The felspars include a few sanidines.

The next rock is one the identification of which is a little uncertain, as it approximates in its characters to the augite-andesites. Mr. Percy Smith states that it is the commonest type of lava on Sunday Island. It is a rock with a black ground-mass of resinous lustre, in which are scattered numerous white felspars reaching 0·2 inch in diameter, giving the rock a conspicuously speckled appearance. Less conspicuous are a few equally large dark-green augites. The microscope shows that the felspars are nearly all plagioclases; there are, however, a few sanidines in Carlsbad twins. The ground-mass consists of numerous small slender felspars and less abundant augite, cemented by a glass containing pellucid microliths and dusty grains of magnetite. The proportion between the minute crystals and the glass with microliths varies considerably in the specimens from different parts of Sunday Island. In some varieties the ground-mass consists so largely of glass containing microliths, that this character, combined with the total absence of olivine and the presence of a small proportion of sanidines, entitle the rock to the name of augite-andesite. There appears, therefore, to be a transition amongst the Kermadec lavas, from basalt rich in olivine, through basalt poor or wanting in this mineral, to a characteristic augite-andesite.

In the yellow volcanic tuff of the cliffs on the north side of Sunday Island, and also along the shore below the cliffs, were found nodular masses of dark-green augite, yellowish olivines, and glassy plagioclase crystals. The augite predominates, and forms crystals reaching an inch in length. Microscopic sections of these nodules show their origin, for here and there between the crystals may be detected a small amount of a volcanic glass with microliths, etc. The nodules are simply aggregations of the large crystals formed in the lavas, and have probably been ejected as bombs during an eruption.

Glassy rocks.—Rounded bomb-like masses, and irregular fragments of a black rock with pitchy lustre, occur in the recent crater on Sunday Island. There are a few minute crystals visible to the naked eye, but not enough to take away from the lustre of the stone. Under the microscope, the rock is seen to consist chiefly of a brownish glass, finely spotted and clouded with grey. The grey parts are closely charged with rod-like pellucid microliths, and also finer indefinite granules. The brown parts of the glass are not so fully devitrified, and here and there are to be seen quite pure and free from microliths. Octahedral crystals of magnetite occur in the grey spots, the glass being, as it were, cleared and bleached around the magnetite, suggesting that the bleaching of the glass in spots is due to the withdrawal of the iron oxide from an originally brown glass. In this ground-mass are embedded a small number of crystals of plagioclase, some sanidines, augite, and magnetite. These secretions, however, form but a small proportion of the whole mass of the rock. Reduced to powder, and digested with hydrochloric acid, the rock yields a quantity of iron in solution, but is otherwise only imperfectly decomposed. Rosenbusch has divided the basic glassy rocks into tachylite soluble in acids, and zyalomelane insoluble in acids. The present variety will therefore be a zyalomelane, and not a normal tachylite.

Several varieties of glassy lava are found in the pumiceous tuff on Macaulay Island. Amongst these is a pitch-stone, much resembling the one above, but richer in microliths. It shows a yellowish-brown glass, in which are colourless spots: in the coloured glass the pellucid microliths are fairly abundant, but the colourless spots consist of dense nests of microliths and magnetite dust. In other specimens the devitrification has extended further, so that the nests of microliths join with neighbouring patches, giving the rock a mottled or cloudy appearance, and finally converting it into a grey mass of felted microliths and magnetite dust imbued with glass.

In the recent crater of Sunday Island were found masses of finely-porous rock of a dark-brown colour. The rock is almost porous enough to be called a pumice, and under the microscope shows a brown glass with very numerous steam cavities. The glass contains vast numbers of slender pellucid microliths, the largest of which polarise, and a few minute magnetites. The larger crystals are very few in nnmber, and are like those in the last mentioned rock.

Another kind of glassy rock from the pumiceous tuff of Macaulay Island has the full vitreous lustre and black colour of a true obsidian. It shows, however, none of the conchoidal fractures of the typical obsidian related to acid rocks, but breaks into irregular little pieces with uneven surface. Towards the edge this glass becomes porous, and passes into a brownish-grey pumice. Microscopic sections show a glass which is yellowish-brown even in their section. This glass is nearly pure, containing only a small number of pellucid microliths of felspar, and probably augite. Some crystals of felspar (both plagioclase and sanidine), augite, and magnetite are embedded in the glass, as well as slender columns, which are rather strongly dichroic in longitudinal section, and appear to be hypersthene. Specimens of a pale-reddish or yellowish-grey pumice from the recent crater of Sunday Island are the frothy condition of a volcanic glass similar to the one just described. This glass cannot be termed a tachylyte proper, for it does not gelatinise on digestion with hydrochloric acid, though the acid decomposes it to a certain extent, extracting a good deal of iron. It seems to be of an intermediate character, and to be the glassy form of a rock of less basic character than basalt, probably of augite-andesite.

It has already been stated that, with one exception, the rocks found on the Kermadecs were of distinctly volcanic origin. The exception is formed by pebbles and boulders of a light-coloured rock, found only on the beach at Sunday Island. It can be recognized by the naked eye that the rock is a crystalline granular aggregate of a dull white felspar, quartz, and hornblende. The microscope shows, in addition, grains of magnetite. The felspars are chiefly orthoclase, but plagioclase is present in smaller proportion. No trace of any ground-mass appears between the crystalline elements, and the rock is therefore one to which the name of hornblende-granite would naturally be given. Another variety of the same rock is very poor in hornblende and richer in quartz, which shows a distinct granulitic, or almost micro-granulitic, character.

The occurrence of a granitoid rock on these islands in mid-ocean is somewhat unexpected, and is one to which much interest is attached, when considered in connection with speculation as to the former extension of land in the Pacific Ocean, especially as the Kermadecs are situated along the submarine ridge which stretches out from New Zealand to the north-north-east. The fact that the rock is found only in detached masses on the beach, suggests the question whether they can be of foreign origin; whether, for instance, they have been brought as ballast by some ship. The number of the boulders, and their size, (attaining a diameter of 2 feet or more,) forbids this supposition. Until more information is gained by the further examination of the islands, the most probable explanation of their presence on the Kermadecs is to suppose them to be portions of deep-seated rocks, possibly rocks which represent lavas which have solidified at great depth from the surface, and that they have been torn off from below and brought up to the surface during an eruption. If this be the case, blocks of the rock may yet be found, either embedded in the lava streams or lying in the volcanic tuffs of the islands.

Art. XLII.—*Notes on the Physiography and Geology of the King Country.*

By Laurence Cussen.

[*Read before the Auckland Institute, 14th November*, 1887.]

Plate XIX.

The district to which these notes refer comprises an area of 4,000 square miles, extending southwards from Alexandra and Kihikihi for nearly 100 miles: bounded by the Waikato River and Lake Taupo on the east, and on the west by the sea, from Kawhia Harbour to the Mokau River. The triangulation of the district was entrusted to me, and I have been for three years engaged in it. This description professes to be simply one of the topography of the country, with such notes on its geology as time and circumstances would allow me to make: it is given in the hope that it may serve to assist the geologist visiting the district in the future, and in the meantime throw some more light on the geology of a country of which very little is known beyond the general descriptions of Dr. von Hochstetter, which, however excellent in themselves, include only a small portion of the area under consideration.

The River Basins.

The three chief river basins by which this country is drained are those of the Whanganui basin, with a drainage area of 960 square miles; the Mokau, 880 square miles; and the Waipa, 820 square miles. Then there are the rivers and streams which flow into the Waikato River from the west, draining 860 square miles; those which empty into Kawhia Harbour and the sea on the West Coast, including Marokopa and Awakino Rivers, draining 720 square miles; and the western side of Taupo Lake, which has a drainage area of 810 square miles.

Surface Configuration.

An idea of the surface configuration may be gleaned from the general sections which accompany this paper. It may be said to be that of a broken, hilly country, with a main range traversing it from south to north. This range is not, however, a continuous unbroken chain: it begins 10 miles to the westward of the Tongariro group; sweeps round 15 miles to the west of Taupo Lake, under the name of the Hauhungaroa Mountain, its height varying from 3,000 feet to 3,780 feet above the sea-level. The Whanganui River takes its rise in the Tongariro Mountain, and flowing westerly cuts through the range immediately to the south of Maungaku, where it traverses a formation of clay marls, overlain by beds of tuff. Pureora, the most prominent peak on the range, lies 12 miles in a north-west direction from the northern end of Lake Taupo; its height is 3,800 feet above the sea. It rises with a gentle and regular slope from the Maraeroa Plain, which lies 10 miles west of it; its slopes are clothed with forest, which disappears near the top, leaving the summit nearly bare, clothed only with tussock grass and scanty scrub.

Three miles to the northward of Pureora stands the picturesque and interesting mountain peak of Titiraupenga, an isolated volcanic rock formed of augite-andesite. Its position and structure would suggest that it was probably the "plug" or neck of land of an ancient volcano, from which the looser materials forming the cone had been removed by denudation. It stands out a most conspicuous landmark at the end of the range, its bare sides standing perpendicularly 200 feet above the mountain. It is a lonely, isolated column of rock, visible for many miles around, and with its mural sides looks from a distance like the ruins of an ancient castle or "Round Tower."

Northwards from Titiraupenga the country falls, and there is a saddle or break in the range at the Maraeroa Plains, a rather extensive area of flat and table lands from 1,400 feet to 1,800 feet above sea-level, composed mainly of the tuff beds, to be mentioned again, and covered with a deposit more or less heavy of pumice sands. The land here is of medium quality. Mixed with the pumice deposits is a considerable quantity of organic soil, derived from the marl formations which flank the neighbouring ranges. The open plains are surrounded by forest, which covers the slopes of the hills, and occupies patches on the plains in picturesque clumps and tongues of bush. The Ongarue River, the chief tributary of the Whanganui, rises here, also the main tributaries of the Mokau and Waipa Rivers.

From Maraeroa the land rises again to the northwards, continuing the direction of the main range, under the name of Puke-o-kahu, 2,775 feet; Ranginui, 3,224 feet; Te Ranga. 2,809 feet; and Wharepuhanga, 1,942 feet above the sea. From Wharepuhanga the range falls away to the northwards, and a low valley, 500 feet above the sea and 7 miles wide, separates Wharepuhanga from Maungatautari, an isolated rhyolitic mountain on the line of the main range, 2,628 feet above the sea. The general character of the formations along this main range is tufaceous sandstone, rhyolitic rocks, andesites, and palæozoic slates, the latter appearing in several places along the top of the range, and cut through by the deep-worn water channels on its western slopes.

Parallel with the Hauhungaroa Range, and immediately to the westward of it, lies the Ongarue Valley. The upper basin in the valley is a greatly depressed area, 15 miles in length from north to south, and from 6 to 8 miles wide. Surrounded by lofty mountains from 2,000 to 3,700 feet above the sea, the valley drops almost suddenly to 600 feet above sea-level. The drainage area of this basin is comparatively small, only about 250 square miles. It is bordered in many places by steep coast-like cliffs of tuffs, andesite, and agglomerates, standing out as greatly denuded fragments of the masses which lie at the back of them. The valley itself is partly filled up by the later-formed deposits of pumice and detritus carried down from the hillsides by the surface waters and running streams.

It would seem almost incredible that this great deep valley owes its origin to the ordinary denuding agencies, and it is more probable to be partly the result of a great earth fissure, connected with the volcanic movements to the eastward, and possibly a syncline in connection with the Hauhungaroa Range. It may also be remarked that the Hauhungaroa Range runs parallel with the great fissure of the Taupo volcanic zone, thus apparently showing a sequence of the volcanic operations by which the mountain chains and valleys of other parts of the world are formed.

The Tuhua Mountain is a very prominent and interesting feature in this part of the country. It stands as an isolated mountain on the eastern side of the Ongarue Valley, and 6 miles to the west of the main range. Its height above the sea is 3,425 feet. It is thus quite as high as the main range, which it stands 6 miles away from. On the summit rest large rounded boulders of tufaceous sandstone over 20 feet in diameter. The sides are flanked by a silt-like marl deposit (to be referred to again). On the top is a broad flat platform, over 60 acres in extent. On the south and north the mountain sides are very steep, and in some places quite precipitous, so that vast quantities of material have rolled down into the valleys in extensive landslips, evidences of which both old and recent are to be seen on the southern, western, and northern slopes of the mountain. Hikurangi Mountain is also an interesting feature of the valley, and from a geological point it is of much importance. It is formed of soft tufaceous rock, with hard rhyolitic rock interbedded with it. The sides of the mountain are flanked with brown and blue clay marls, and probably the base is composed of masses of the same rocks, as from near the base, at an altitude of 800 feet above the sea, two dense and powerful mineral springs appear. These are highly charged with salt, and are of considerable importance from their medicinal properties, as disclosed in the analysis by Professor F. D. Brown, and referred to in his paper, "Notes on a Salt Spring in the King Country," read before the Institute on the 14th of November, 1886. Hikurangi looks at a little distance away from it like a very regular volcanic cone, rising from a ridge in the valley to a height of 2,580 feet above the sea. Its slopes are clothed with forest. Towards the top its sides are steep, almost precipitous, and it has a flat square-cut table land on top containing 50 acres. Tuhua and Hikurangi Mountains, with their broad platforms on top and steep mural sides, standing out in isolated positions in the valley, ranges which correspond with them in height bordering the valley on either side, are all circumstances suggestive of the fact that these hills formed part of the ancient plateau which occupied the valley.

THE LANDSCAPE.

Probably in no part of New Zealand can be found landscape so varied and picturesque as may be seen in favourable weather from some of the lofty peaks in this part of the district. Viewed under the conditions in which I saw it, it would be difficult to conceive a landscape of greater natural variety and grandeur. It was at sunrise on a clear frosty morning towards the end of May, from the summit of Pureora, 3,800 feet above the sea, overlooking all the surrounding country. The high mountainous district southwards of us was covered with snow; Taupo Lake seemed to be spread out at our feet, its 425 square miles of clear mirror-like surface reflecting the shadows of the eastern hills and promontories of the lake, cast across it by the rising sun. To the south the giant mountains of Tongariro and Ruapehu, the latter mantled in an unbroken sheet of snow, which covered 6,000 feet of its rugged sides; the regular conical outline of the active crater cone at Ngauruhoe, its steep black sides kept bare of snow by the internal heat, and its funnel-shaped crater at the summit,—were distinctly visible to us. Steam ascended slowly from the crater, forming a white cloud-like canopy at the cone.

To the north and east wound the valley of the Waikato River; along its course columns of steam arose from the hundreds of hot springs, fumaroles, and *puhias* in the "great fissure" of the Taupo volcanic zone. Several of the dilapidated volcanic cones were in view, from whose craters in ages past were vomited forth the streams of lava, mud, ashes, and breccia that are spread far and wide over the surrounding country. Amongst those visible were Pihanga, Kakaramea, and the Tongariro groups—the latter rearing their great crateral cones from 6,500 to 7,480 feet above the sea. To the north of Lake Taupo, Mount Tauhara, described by the Assistant Surveyor-General in his account of the "Taupo volcanic zone," as "a fine conical hill 3,603 feet high, with a crater on top, now extinct, and clothed at the bottom and western side with a forest of fine trees. The crater rim is very perfect on the north, east, and south sides, but the western, that directed toward the prevalent wind, has broken away. At its base, on the shores of

Taupo Lake, and along the Waikato River, on both sides for miles down, are found innumerable hot springs, all in a state of great activity." To the south-west, at a distance of 98 miles, the snow-clad sugarloaf peak of Taranaki (Mount Egmont) reared its head high above the surrounding landscape, 8,270 feet above the sea. We had therefore, as it were, spread out before us, and easily recognisable, the great volcanoes of the Taupo volcanic zone, nearly all now extinct, but having close to their base steam rising from the hot springs by which they are surrounded, showing, as Mr. Percy Smith says, "that the volcanic forces have simply changed their position and the character of their activity, and are not dead;" and with these were also within our view some of the grandest variety of lake and mountain scenery in the Colony.

GEOLOGY.

I regret very much that I cannot supply anything like detail geological sections—to work out the geology of this large district would be a work of much time and trouble. The superficial deposits of pumice to the westward of Taupo Lake, and all over the valleys of the Tuhua District, render it very difficult to trace the junctions of the beds. I brought with me to Auckland typical specimens of the chief rock formations found in the district; I am indebted to the great kindness of Professor Thomas for their names. At the cost of considerable time and trouble he made numerous microscopic sections of the rocks, and thereby chiefly I am enabled to give such details of the geological formations in the district as this paper may contain.

CARBONIFEROUS.

Rocks of the younger palæozoic formation—fine grained argillaceous slates (the Maitai slates of Hochstetter) appear in at least four places along the top of the main range. At Hauhungaroa they are found at an elevation of 1,950 feet (nearly the summit of the range), over rhyolitic tuff and andesite; they appear lower down on the same part of the range in the deep worn beds of the Pungapunga and Mangakotuketuke Streams, at a height of 800 to 1,000 feet above sea-level. At Puketapu, on the Tuhua and Taupo native track, slates are found at 1,700 feet above the sea.

On the eastern slopes of Ranganui and Rangitoto they are seen to be cut by the mountain streams in at least two places, at an elevation of about 1,800 feet above the sea. On the Mokau-iti River, near its junction with the Mokau, slates form the masses of rock through which the river has scooped out its bed. Hochstetter says that "at the Wairere Falls, on the Mokau, slates of the same description as those at Taupiri form the rock masses over which the river falls." So far as I have seen, the slates always appear in patches when found at high elevations on the ranges, but when seen in the deep worn beds of the stream, near the base of the mountains, they are in large compact rock masses.

Tertiary Formation.

To this formation, I believe, belong the clays and limestones of the Mokau Valley. Hochstetter says: "The bottom of the Mokau Valley is composed of tertiary clays, impervious to water; while at the slope of the hills tabular limestones protrude, the heights themselves being formed of trachyte tuff."

These tertiary limestones occupy an area of about 200 square miles in the valleys of the Mokau and Mangapu. In the Mokau Valley they seem to have occupied an area of depression, 25 miles in length from north to south, and about 8 miles in width, surrounded by high hills, 1,200 to 1,800 feet above the sea. The limestone beds have undergone immense denudation; they stand out on the sides of the valleys in picturesque detached masses, resembling the ruins of old castles and fortifications, frequently occupying positions 300 feet above the level of the valley, the peculiar slab-like weathering of the laminated masses making them look like the remains of ruined masonry. The colour of the limestone on the surface is white, probably owing to weathering, but it passes into a compact mass of bluish fine grained rock underneath.

The tertiary limestones occur also on the Marakopa River, at Te Anga, 20 miles inland from the mouth of the river. They are seen here in picturesque columnar rocks, cleft and worn into many shapes and forms, and forming long high walls along the river sides. At Rakau-nui River, Kawhia Harbour, there is also a great development of the limestone formation. Here it forms interesting landscape scenery, in picturesque islands and promontories; portions of the rock masses being dislodged and tilted up in the process of denudation, look as if they were disturbed by violent volcanic action. All this limestone formation is noted for its numerous caves, underground watercourses, funnel-shaped holes, and overhanging rock ledges. The caves were, in former times, no doubt shelter caves and sleeping places of the moa, and in years gone by their bones were found in the caves in large quantities. They have, however, long since disappeared, and we were never fortunate enough to find any relics of the moa in the caves.

Lying to the eastward of the limestone area of the Mokau Valley is an elevated plateau, which rises gradually in an easterly direction, or towards Taupo. The general height of the plateau above the sea is from 1,500 to 2,000 feet; it is divided by deep water-worn gullies into long winding spurs. This plateau extends from the slopes of Rangitoto Mountain southwards for a distance of about 30 miles, and it has an average width of about 15 miles between the valleys of the Mokau and the Ongarue Rivers. The high ground of the plateau is covered with forest, and the soil is of good quality; the valleys are open—probably the result of continued denudation; their bottoms are for the most part covered with deposits of pumice sands, and consequently poor and unfit for cultivation as a rule. The long sinuous spurs of the plateau are composed of rhyolites, andesites, and tuff, the latter predominating, and with it are interbedded masses of volcanic agglomerate, and enfolding with them rounded pebbles of igneous rocks, and those of slate rocks also. At their base are beds of marl, shale, and sandstone; in what position these beds lie relatively I cannot say with any certainty—I never had the time nor opportunity to trace out their junctions properly. I think the beds of marl and shale rest conformably on the sandstone, as they appear to do in one of the deep-worn banks of the Mapui Stream near the Mokau. The tuff beds overlie the marls, but whether conformably or not I cannot say; the colossal masses of tuff rise up one after another, bordering the valleys; isolated peaks and blocks of it stand out on the ridges, with here and there greatly denuded sides.

It would seem that the plateau was formed of a continuous sheet of the formation of which these blocks and ridges are the remains, and the softer portions being carried away by denudation, the river valleys were formed, and varieties of contour worked out all over the plateau. The beds of tuff contain large quantities of pumice in various sizes, up to a foot in diameter. Some of these are abraded and rounded at the edges, others are sharp and angular. I did not notice any fossils in the beds. These tuff beds much resemble those of the Patetere plateau, to be seen between Waotu and Lichfield; they have a thickness of probably 1,200 feet on the plateau just described.

A reference to the section will show that the plateau rises with a gradual and regular slope of 8 degrees, from the Mokau Valley eastward to a height of 2,800 feet on the Tangitu Range; and then there is a sudden fall of 1,600 feet into the valley of the Ongarue. If the line of slope be still produced in an easterly direction, it will meet the summit of the main range at Hauhungaroa, 12 miles to the west of Lake Taupo, and from there the land slopes into the Taupo basin at an angle of 14 degrees. I have dwelt considerably on the description of this tufa deposit, for the reason that it occupies the largest area of any formation in the district, and is persistently associated with all the other formations, but in what relation to them my investigations were not complete enough to show. I believe that in the Mokau Valley, and in the plateau between it and the Ongarue, the tuff beds lie conformably on the tertiary limestones and calcareous clay marls; but their relation to the marl beds in the Ongarue and Upper Whanganui valleys is, so far as my knowledge goes, very doubtful. I believe the latter marl beds are of three different ages, and the tufa beds are contemporaneous with those of the middle period, for reasons which will be shown hereafter.

Miocene.

The clay marls, or "blue papa rock," of the Upper Whanganui belong, I believe, to this formation. These beds occupy a large area, extending inland from Whanganui to the Tuhua. It is a fine-grained calcareous and argillaceous formation of great thickness; it can be traced to an altitude of 2,100 feet above the sea on the Hunua Range, 12 miles south of Taumarunui, where it is exposed in great masses in the numerous landslips on the mountain sides. The beds dip to the south and the south-west at angles varying from 8° to 15°. They sometimes enclose bands of more compact, harder, and more sandy rocks; and in the valley of the Otaunui Stream I noticed at one place large partly rounded boulders of tufaceous sandstone (or possibly septaria,) appear, interbedded with the marls. Resting on these marls, and probably conformable to them, are the tuff beds before mentioned as so extensively occupying the higher area of the plateau. They occur here in a precisely similar manner, but not quite so persistently; and here they are associated with lava floes of rhyolites and andesites.

I have said that I considered the marl beds of this part of the district were of three different periods of deposit. I regret that I never met with an opportunity of examining the beds at their junctions. The valleys are here so much covered in with superficial pumice deposits that to obtain sections will be a work of time and trouble. It seemed to me, however, that the tufa beds resting on the lower blue marls lie conformably on that deposit. Resting on the tuffs, again, is another deposit of the same blue-clay marl apparently; this forms the rock masses of the range west of the Ongarue River, known as Tangitu, Maungarahiu, Tapuewahine, etc., through one of the saddles of which (the Paro-o-te-rau) the tunnel on the Main Trunk Railway is now being formed, and the character of rock being driven through is, I believe, all the "blue papa." Fossils are very scarce in the deposit, and difficult to save; they crumble away on being exposed to the atmosphere. The beds are distinctly stratified, but I have not ascertained their dip. They are greatly subject to atmospheric influences, and, whenever exposed, are quickly channelled by watercourses and removed by denudation.

At the crossing of the Whanganui River, on the native track between Taumarunui and South Taupo, at a place called Taringapupu, the river bed is scooped out in blue marl rock—whether of the older Whanganui series or the later deposit I cannot say; and the relative ages of these beds must remain an open question until their fossils are collected and compared.

Further to the eastward, and within 15 miles of Taupo Lake, in the bottom of the Waipari Stream, these marl beds are also exposed. They appear to dip to the westward at an angle of 10 degrees. They are here interbedded with coarse conglomerates, which enfold rounded slate pebbles and particles of rhyolite and trachyte lavas. I saw no fossils here, but I did not search much for them, and probably a closer examination would disclose some. Where the deposit is crossed by the Taupo track the height is 2,200 feet above the sea. These beds are also exposed four miles higher on the same stream, at an elevation of 2,600 feet, and here they have interbedded with them thin layers of yellowish clay or mud.

In describing the third, or more recent, marl deposit in the Taupo and Tuhua Districts, I do so with considerable diffidence, lest my remarks may be misleading.

On the higher elevations, on the ridges and mountain sides west of Taupo Lake, and in the Tuhua District, appear in many places what would seem to be the remains of a light deposit of silt-like clay marl, the greater part of which appears to have been carried away by atmospheric denudation. It consists of a fine-grained clay marl, calcareous and sandy in some places, in others more argillaceous in character. It has its greatest development in the little valleys on the top of the ranges. Lower down, it appears only in places where it may have been carried down by recent landslips. It is found overlying all the other formations. Thus, at Matere, on the Hauhungaroa Range, it is found at an elevation of 3,000 feet above the sea, lying on volcanic tuff and rhyolitic rock. On the Tangitu Range, west of the Ongarue River, it overlies the second marl, or blue papa deposit. In some places the colour is a greyish-brown, in others blueish, and again brown or brick-colour. On Matere Range it flanks the mountain side on the west, occupying the little valleys between the edges in thin, fragmentary deposits. I have constantly met with it in fragmentary slabs all over the Tuhua District, but nowhere else. It is thus only found to the west of Taupo, and at a distance of about 40 miles from the centre of the lake. I saw no fossils amongst it. A sample of the deposit from Hauhungaroa was found to be highly calcareous; whilst another, having the same appearance, and apparently the same kind of deposit, found on Taurewa Mountain, 10 miles west of Tongariro, proved to have no trace of lime in it.

The source of this deposit is an interesting question. It may possibly be laid down in the form of volcanic mud, connected with the outburst of the Taupo volcanoes, when the great masses of pumice which cover the surrounding country were showered out; or it may be a silt-like sediment of mud and clay brought down from the higher elevations by running waters, and deposited at the margin of the sea, at a time when the land stood 3,000 feet lower than it now stands; in which case it would be of much interest in studying the changes in the level of the country, as connected with the great volcanic movements in the Taupo volcanic zone, and pointing to the existence of much higher land, as occupying what is now the position of Taupo Lake.

PLEISTOCENE BEDS.

The only other formations which remain to be mentioned comprise the recent deposits in the river valleys, consisting of the loose materials brought down from the higher ground by the surface water and running streams, and including the detritus from the various formations mentioned. Of these deposits the most interesting and important developments occur in the valleys of the Upper Whanganui and its tributaries. The mountainous nature of the country gives to the streams the character of mountain torrents. The soft marl formations, loose superficial pumice, and tolerably soft tufaceous rocks of the district are all much subject to the ordinary effects of subaerial denudation, and in consequence of these agencies almost incredible quantities of matter are brought down by the rivers and streams after every fall of rain. The surface configuration of the country is undergoing constant alteration, new landslips constantly appearing on the mountain sides, some of them of great extent, carrying away large forest trees and masses of rock, frequently damming up the courses of streams, and forming temporary small lakes. Unfortunately, the greater portion of the material deposited in the river valleys, and that which occupies the surface, covering up the fertile soil derived from the marl formations, is the superficial pumice deposit to be referred to more particularly later on. Many of the valleys are filled up to a great depth with pumice sands; sometimes in terraces; sometimes in level plains.

In the valley of the Ongarue these pumice beds display a regularly stratified form of deposit, particles and blocks of various sizes up to a foot in diameter lying in alternate layers of finer and coarser fragments. With them are interbedded fine layers of argillaceous strata, and trunks and branches of trees partly changed into charcoal. These facts go to show that the valley was once the bed of a lake; the stratified pumice beds and horizontal terraces could only result from still-water deposit. The valley of the Whanganui, above its great bend at Taumarunui, is also filled up with great beds of loose pumice, in places 2 miles wide and over 100 feet in depth; it seems probable that these were also lake beds at one time. The most noticeable of these is the Rena Plain, 10 miles east of Taumarunui; its width is nearly 2 miles, and its length about 4 miles. The river has cut a deep channel through the pumice beds, which are over 100 feet in depth at the lower end of the plain, where the river course was probably dammed up, and they gradually thin out towards the head of the valley, where their depth is only 8 feet. The bed rock at the head of this valley is "blue papa."

The deep-channelled bed of the Whanganui River between Taumarunui and the sea, with its perpendicular banks, often over 200 feet high, carved out of the blue marl beds, the absence of river terraces or anything approaching a wide, extensive river valley, all bear evidence of the rapid upheaval of the land in the interior. The distance from Taumarunui to Whanganui by the river is about 180 miles. No road nor native track, so far as I know, traverses the country, which is accessible only by the river. The journey from Taumarunui to the coast in a canoe takes four days. The whole course of the river is a succession of magnificent gorge scenery, a luxuriant, tropical-like growth of fern-trees and variously-tinted undergrowth, fringing the banks and mixed among stately forest trees, which overhang the river high above. There are several extensive rapids, which require skill and care to pilot the canoe over. Picturesque buttress-like headlands have been rounded out on the marl beds by the current of the river. They look like the prow of some great vessel; their sides are marked by rows of holes, one tier above another, formed by the poles used to propel canoes up the stream.

PUMICE DEPOSITS.

I have frequently referred to the superficial pumice deposit in the district. It is found most persistently in all the valleys, terraces, and flats within a radius of 40 miles round, from the south-west to the north-east, from the centre of Taupo Lake, sometimes covering the surface with a deep deposit of large and small particles, and rendering land which otherwise would be fertile quite arid and useless. It is particularly detrimental in the valleys of the Tuhua District and Upper Whanganui, where large areas of level land along the river sides and on the terraces are rendered unfit for cultivation. This pumice deposit appears everywhere more or less within the limits mentioned above; but on the mountain tops and down their slopes it is seen for the most part merely as a thin sprinkling, and accumulates more in the little valleys and flats on the hillsides, frequently to a depth of 25 to 50 feet, carried there, no doubt, by the surface waters and the wind. In the Tuhua District, a few miles to the south-east of Taumarunui, a fine tract of about 10,000 acres of good soil, derived from the blue papa rock, is partly spoiled by the pumice filling the valleys and covering the rolling country on the slopes of the hills. I have carefully studied this pumice deposit with a view to ascertaining the mode of distribution. Between Taupo Lake and the valley of the Ongarue, a distance of

25 miles, the pumice is most persistent, and does not appear to alter much in the form of distribution or in the size of the particles. In the valley of the Pungapunga, 15 miles west of Taupo Lake, blocks of pumice measuring over 2 feet in diameter are found, and all the valleys and flats are covered deeply with the deposit. As we recede from Taupo the pumice deposit thins out gradually, and the particles decrease in size, until at a distance of 50 miles from the centre of the lake very little is seen, and that in very small particles. I have frequently seen pumice mixed with the earth brought up by the roots of trees which were blown over by the wind. I have also found it, at a depth of 8 feet or more, when constructing trigonometrical stations on the mountain tops, but only in such manner as I think may be accounted for by its becoming mixed up with the earth in the ordinary course of surface-soil formation, its movements by the roots of trees and other vegetation and by the action of earth-worms. The pumice must, I think, be regarded as a superficial deposit, and probably the product of some of the latest volcanic efforts. I saw no trace of the remains of a crater within the district in which it is found, although having, in the course of my duty, visited nearly all the higher mountains. Round Tongariro and Ruapehu very little pumice is found in comparison with other localities; whilst at the Waimarino Plains and westward of Ruapehu scarcely any is seen. The Assistant Surveyor-General, in his "Geology of the Northern Portion of Hawke's Bay," read before the Auckland Institute, 27th November, 1876,* mentions the pumice as occurring in that district under somewhat similar conditions. He says: "Towards the east the deposit gradually thins out, until, approaching the vicinity of Poverty Bay, very little is seen." The portion of Poverty Bay referred to by Mr. Percy Smith would probably be about 50 miles from Taupo Lake; thus the limit of the pumice deposit in that direction corresponds with that on the west of the lake.

Mr. Percy Smith further states: "The general opinion appears to be that this pumice was ejected from Tongariro and adjacent volcanoes, and was spread over the surface of the country by the wind. There are certain considerations which favour this view, such for instance as finding the greatest thickness of the sand on the lee sides of high ranges, where it would naturally accumulate, and also from the fact that the size of the particles appears to diminish as we recede from the supposed centre of distribution. The only other hypothesis which would account for the presence of pumice over such an extent of country is, that it has been carried into its present position by water." This hypothesis seems to me quite out of the question as applied to the King Country. The deep beds of pumice in the valleys of the Whanganui, Pungapunga, and elsewhere, are unquestionably alluvial deposits, the blocks of pumice and loose sand being washed off the hill-sides, and deposited partly, it may be, in the still waters of long narrow lakes, which might be formed by the river beds being temporarily choked up by trunks of trees and detritus carried down in heavy floods.

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* "Trans. N.Z. Inst.," vol. ix., p. 565.

The large area of country, and great height at which pumice is found, precludes the idea that it is due to the action of water, and all the evidence so far goes to show that it was spread in the air, and, I think, points to the region of Lake Taupo as the centre of distribution. It is true that many of the particles, even amongst those found on the mountain tops, have an abraded appearance; but would not this be the natural result of their mode of ejection from the crater, being carried by the violent tornado of escaping gases high up into the air, and for miles in any direction that the prevailing wind may take them, their attrition in the air rounding off their angles?

LAKE TAUPO.

In the month of January, 1886, I made a hasty hydrographic survey of Taupo Lake, in connection with the topographical survey of the country. I may here give briefly the results of my observations, as they are intimately associated with some interesting questions referred to, and may contribute to forming a correct theory as to the origin of the basin. The lake covers an area of 154,680 acres, being 24 miles 70 chains in length, and 16¼ miles wide; the mean depth is 65 fathoms or 390 feet; the greatest depth, at a point nearly in the middle, being 89 fathoms or 534 feet. Shallow water was found only at one place in the lake, that is on the Haromatangi Reef, which lies nearly half-way between Motutaiko Island and Karaka Point. Here the rock is covered by only 7 feet of water. The northern and western shores of the lake are formed of steep rugged cliffs of rhyolites and augite-andesites, with great compact masses of tuff. The height of the cliffs in the western bay varies from 100 feet to 800 feet, with deep water close alongside them, from 40 to 50 fathoms being found with our boat made fast to the cliff. At Karangahape Point the cliff is 1,500 feet in height, from its base at the bottom of the lake to the trig. station on its summit. As will be seen from the section, (Plate XIX.,) it rises perpendicularly from the floor of the lake, almost overhanging the water; thus, in taking soundings, with our boat's stern touching the cliff, the lead-line showed a depth of 390 feet, and a portion of the cliff 600 feet above our heads seemed to overhang the boat. Behind these cliffs on the western side of the lake, and between the lake and the Hauhungaroa Range, are immense beds of white pumice sands, through which the rivers and streams have worn out for themselves deep channelled courses, with frequently wide canons at the bottom. Part of the northern shore and a great deal of the eastern shore of the lake is formed by cliffs of pure pumice, in one place 300 feet above the lake, and spreading thence southerly and easterly to the slopes of the Kaimanawa Range, covering the country with a deep deposit of over 100 feet in thickness. In a north and north-east direction it extends for many miles, covering the Kaingaroa Plains, and leaving deep deposits over all the valleys from Taupo to Atiamuri and Whakamaru.

Motutaiko is an interesting feature of the lake. It is formed of a column of rhyolitic lava ascending perpendicularly from the floor of the lake to a height of 600 feet, half of it being above and half below the water. On the north side of the island are masses of coarse conglomerate, consisting of glassy varieties of rhyolite, obsidian, etc., and interbedded with tuff and pumice sands. The rhyolite on Motutaiko is a very remarkable kind of lava, and I have seen nothing like it elsewhere in the district. It has a decidedly lamellar or stratified structure; the thin sheets of stone lie one over the other, and would seem to have been of a very viscid character, cooling as the thin liquid sheets moved over one another, and assuming very ropy, twisted, and contorted forms. This is doubtless the same class of rock discovered by Dr. Hochstetter, which, he says, the Natives called *taupo*, and from which the lake is said to have its name. In his description, he says:—

"It consists of an extremely remarkable kind of rock, which has attracted the attention of every stranger travelling along the lake. It is a volcanic rock of very striking lamellar structure; like the leaves of a book, sometimes of microscopic fineness, the thin lamellar sheets of stone lie one above another. Greyish black layers, resembling silicious schist of various lighter and darker shades, alternate with pearl-grey, violet, flesh-coloured, sometimes even with brick-coloured layers, so that the streaky mass reminds the observer of agate. From the numerous white transparent quartz grains, and small yellowish-white felspar crystals (sanidine) enclosed, it moreover has a porphyritic structure, while in smaller or larger vesicular spaces light-brown mica appears. There can be no doubt of the genuine lava character of the rock. As by the stretching and pulling of a mass composed of mixed fusions, artificially streaked glass is produced, so this rock is likely to have originated from a volcanic magma composed of various stone fusions."

Richthofen has, in 1860, described quite a similar kind of rock from the vicinity of Tokay, Saraspatak, etc., in Hungary, under the name of lithaidit; while Dr. J. Ratti has named a similar lava upon the Liparian Islands, liparite.

A specimen of the lava from Motutaiko, which I brought down with me, exhibits the peculiar curved and ropy forms in which it cooled, the thin lamellar sheets conforming regularly to the curve of the stone. This island rock is possibly an old volcanic mountain, the lower materials which formed the cone being dispersed by the action of the water and the ordinary subaerial denudation, and now covering the floor of the lake. A distinctly marked terrace extends right round Taupo Lake, 100 feet higher than the present level of the water, indicating that for a long period the lake stood 100 feet higher than it now does; the fall is probably due to the lowering of its only outlet, the Waikato River, where it probably broke through a barrier, about one mile from the point where it leaves the lake. Te Heuheu points out a flat rock, on the edge of the lake at Waihi, which he says his ancestors used for a sacrificial altar shortly after their first arrival in Taupo. This shows that the lake has not altered its level within 400 years.

At Karaka Point, a promontory of the lake 4 miles from Tapuaeharuru, are some interesting caves, worn by the action of the water of the lake on the rhyolite tuff, at a time when the water was considerably above its present level. There is also an interesting natural archway, cut out of the tufaceous rock, and instructive rounded, waterworn, and conical-shaped pillars of the same formation.

It has frequently been suggested that the only one outlet of the lake—the Waikato River—does not seem to carry off as much water as the numerous tributaries supply, and that consequently there may be subterranean passages through which the water flowed to supply the volcanic foci of the district.

Whilst surveying the lake I took the opportunity to measure the volume of its rivers and streams. I append a table showing the results of the measurements, which were very carefully taken. They show that practically the same amount of water is discharged as flows into the lake, the inflow being 16,488 gallons per second, and outflow 16,280 gallons per second.

As to the origin of the lake basin, I think there can be little doubt, from the facts, that volcanic action has played a large part in its formation. It is next to incredible that the waters of the lake could have worked out such varieties of shape and contour as are seen on the great coast-like cliffs of the western shores of the lake. Their whole appearance bears evidence, I think, of violent agencies, either of eruption or subsidence. The immense pumice beds surrounding the lake, which gradually diminish in bulk and size of the particles as they recede from it, are all circumstances which point towards the present site occupied by Lake Taupo as being once the scene of great volcanic activity.

In summarising, it becomes apparent that the character of the land and the quality of the soil derived from these various rock formations must be very variable. Where the soil is derived from the marls, shales, or limestone, it is rich and fertile. Some of the soil of volcanic derivation is also good, but unfortunately a great deal of the flat land and valleys are nearly rendered useless by the surface covering of pumice sands. There is, nevertheless, a large area of good settlement land amongst plateaus and hill slopes, and extensive flats suitable for agricultural purposes in the basins of the Waipa and Mokau.

Gold.

In reference to the mineral character and construction of the main range, as affecting the probability of gold being found there, I trust that I may not appear as propounding a theory or offering an opinion in discussing this large and most interesting branch of the subject.

I have called that the main range which sweeps round to the west of Taupo Lake and reaches the Maungatautari, including Rangitoto and Tuhua Mountains, for these reasons: (1.) That the slates are found along it in many places; (2.) If the line of the range be produced north and south, it will be seen to pass northwards through the Thames, Te Aroha, and Cape Colville, and the Great Barrier Island, and southwards through Tongariro group to the southern side of the Kaimanawa Range; (3.) All along this line are found in greater or less quantity the same class of slates, pointing I think to the probability that this may be at least a branch of the old palæozoic mountain range which, commencing in the south-east of Otago, sweeps round the West Coast to Cook Strait, and thence is said to be continued through the North Island in a north-easterly direction to the East Cape.

It is along this line that the gold deposits at the Thames and Coromandel have been found, and also the reported gold discoveries made at various times at Maungatautari, Tuhua, and Rangitoto.

Mr. Herbert Cox, in his "Report on the Goldfields of the Cape Colville Peninsula, 1882," says:—"The Cape Colville peninsula consists of a hill of slates, overlaid by various volcanic formations. The slates crop out in the lower parts of the gullies cut by the creeks which fall into Cabbage Bay. And although at some places the auriferous reefs are in country which does not appear to have any direct connection with the slate formation, yet at no great depths these rocks are certain to occur." Slates appear along the Hauhungaroa Range in a precisely similar way as they do at the Thames and Coromandel. They are also the basement rock of the district, as appears from their being found at Wairere on the Mokau, north of Maungatautari, in the gorge of the Waikato River. So far as my limited experience goes, it has appeared to me that the general characters of the formations on the main range of the King Country correspond to a considerable extent with those described by Mr. Cox as containing the auriferous series at the Thames. The tufaceous rocks are described as a composition of igneous fragments, and are considered to be auriferous, especially when in the vicinity of slates, and when the tufaceous character is due to the decomposition of highly indurated and metamorphosed masses. It is probable that portions of the masses forming the Hauhungaroa Range are allied portions of the rocks mentioned above, and products of the great volcanic action of the Taupo zone, and appear very like some of the formations of the Thames Goldfields described by Mr. Cox.

In collecting together these notes, gathered rather promiscuously, I have endeavoured to do so in as concise a manner as possible, and in such a form as to be useful in future investigations; but they have run into greater length than I intended.

LIST OF RIVERS FLOWING INTO TAUPO LAKE,

With the number of Gallons of Water contributed by each per second.

Name of River.	No. of Gallons per second.
Hinemaia	
Amaria	688
Waitetiku	19
Tauranga	489
Kuratau	578
Whereroa	152
Mapararoa	56
Whangamata	27
Otakitaki	16
Otutira	68
Tutarueue	80
Waihora	246
Waihaha	588
Whanganui	164
Waikato	9,970
Waimarino	898
Tongariro	552
Small streams	185
Total inflow	16,488
Total outflow	16,230
Difference	258

ART. XLIII.—*Geological Notes on the Kermadec Group.*

By S. PERCY SMITH, F.R.G.S.

[*Read before the Auckland Institute, 14th November*, 1887.]

HAVING lately had an opportunity of visiting Sunday and the other islands of the Kermadec Group, I think it may prove interesting to the members of this Institute to learn a little of their geology, as far as the notes I have will allow me to supply it. It is of some little importance to place on record what is known about the islands geologically, in connection with some ideas that have been given forth to the world as to their flora and the relation it bears to the origin of our own here in New Zealand.

Mr. Cheeseman's notes on the collection he made of the flora will prove of great interest, especially as bearing on questions relating to our own and that of adjacent lands. Into this subject, of course, I do not enter, any more than to illustrate it by notes of the geological history of the group as far as it can be ascertained.

The Kermadec Group is one of the latest additions to the British possessions, and it has a special interest for us, inasmuch as it was annexed to this colony on the 17th August last at the time of the *Stella's* visit, by hoisting the British flag and by formally reading the Governor's proclamation. The group is a very small one, and, but for its position and the great fertility of the soil on the largest of the islands, would be of little value. With the exception, however, of the Chatham Islands it is the most valuable of the several groups of oceanic islands belonging to the Colony.

SUNDAY, the principal island, is situated just 600 sea miles north-east from Auckland; a little to the east of the route to Tonga, and a little to the west of the route to Rarotonga. A line drawn from Sunday Island, situated in latitude 28° 15 South and longitude 177° 52′ West, in a south-south-west direction for 142 sea miles, would strike L'Esperance, a bare rock forming the most southern isle of the group; and close to this line, at 68 miles from Sunday Island, is situated Macaulay Island, and 22 miles from the latter are the Curtis Islands. These fine islands, with a few islets and rocks off Sunday Island, comprise the whole group, which has a total area of 8,200 acres; Sunday Island absorbing by far the largest portion of this, viz., 7,260 acres.

Captain Sever, commanding the transport *Lady Penrhyn*, discovered Macaulay and Curtis Islands on the 31st May, 1788. Admiral D'Entrecasteaux discovered L'Esperance on the 16th March, 1793; and Sunday, or, as he called it, Raoul Island, on the 18th March, 1793. D'Entrecasteaux also gave the general name to the group, calling it Kermadec, after the commander of his consort. The name Sunday was given to it by Mr. Raven, commanding the transport *Britannia*, who passed it in 1796 on his way from Norfolk Island to Cape Horn. He was not aware of its previous discovery by D'Entrecasteaux. The first settlers took up their residence on Sunday Island in 1837, and from that time to the present it has been occupied by various parties of settlers, none of whom, however, ever stayed there any length of time, owing principally to causes which I shall refer to in the geological description.

Situated in latitude 29° 15′ South, the climate is mild and equable, although in winter high winds are of common occurrence. The insular character, doubtless, tempers the heat which might be expected from the latitude. We found the temperature, during our ten days' stay in August last, very pleasant, and slightly higher than that of northern New Zealand.

The islands are wholly of volcanic origin, and are, geologically speaking, of recent date. I have attempted to show, in the case of the Bay of Plenty volcanic district, that all the extinct volcanoes there found, as well as the active ones, including Tarawera and also the points of greatest thermal activity, follow a line drawn from Ruapehu to White Island, which, there is every reason to believe, denotes one of those great fissures of the earth so characteristic of volcanic districts. This linear arrangement of volcanoes is so marked a feature as to render it unnecessary to point out the many countries which illustrate it. In the Kermadec Group, further evidence of the ruling process by which volcanoes are built up along linear fissures is afforded. If we study a map of the Southern Pacific, we shall find that, by prolonging the volcanic axis of the Bay of Plenty, it will strike through this group, and, if continued still further in the same general direction, that Tonga and Samoa will be seen to be in the same line. At both of these places volcanic activity is still to be found, but more especially at the former, where two notable eruptions have occurred within the last few years—viz., that on the Culibras Reef, on the 11th October, 1885, and that at Niuafou in August, 1886.

This line appears to mark the centre of a region of elevation, separated from similar ones on either side by oceans of abysmal depths. Unfortunately, the soundings between the coasts of New Zealand and Tonga are few and far between. The *Challenger*, one of whose special duties was that of deep-sea sounding, only obtained four between the places named—*i.e.*, one off the East Cape, of 700 fathoms; two between Sunday and Macaulay Islands, one 40 miles north of the former; and one of 2,900 fathoms between Sunday Island and Tonga, but 150 miles to the east of a line drawn between those places, and, therefore, off the plateau. A few other soundings have been obtained along this central line by other ships, and these, together with some shoals and reefs lying between the Kermadec and Tonga Groups, all go to prove that the plateau is probably continuous in this direction. Many rocks, reefs, and shoals have been reported from time to time as lying south-westerly from the Kermadec Group, but there are doubts about them all. Her Majesty's ships have frequently searched for them in vain; and it is believed that those who reported them were deceived by the colouring of the water due to the presence of Mollusca.

Although the region under consideration may be called an oceanic plateau, the depth of water on it is very great—deeper probably than the height of most of our northern mountains; and, therefore, when we find little islands like the Kermadecs appearing above the sea, we readily conceive them to be the tops of mountains rising to great heights above their bases. We are happily in possession of a most excellent survey of Sunday Island and the neighbouring seas, made by Captain Denham, of H.M.S. *Herald*, in 1854. From his chart we find that this island stands on a plateau, the waters on which are of moderate though uneven depth. At one mile from the shores the mean depth is about 850 feet, though in one place within half-a-mile of Nash Point it is as much as 1,290 feet. There can be little doubt that this moderate depth—which is somewhat unexpected from the abruptness of the coast-line—is due to the erosion and destruction of the former extensions of the island, the materials of which have been spread over the sea bottom in its vicinity. In the neighbourhood of Macaulay, Curtis, and L'Esperance Islands, we find from Captain Fairchild's soundings that the waters are also comparatively shallow for about a mile off the coasts. As, however, we pass away from the land, between Sunday and Macaulay Islands, a depth of 3,120 feet and 3,780 feet was found by the *Challenger;* whilst 40 miles to the north of the former the depth is 3,600 feet. Sunday Island, being 1,723 feet high, it follows that it is a mountain standing on a broad base, with an elevation of 5,300 feet.

The islands are all, in fact, the tops of volcanic mountains appearing above the sea; and I believe they originated in the eruption of matter from the great fissure I have indicated as probably extending from Ruapehu to Samoa, and which passes through this group.

With regard to the age of the islands, there is very little to guide us in forming an opinion; but bearing in mind Sir James Hector's statement, to the effect that the volcanic activity which caused the elevation of the central plateau of the North Island of New Zealand commenced in Eocene times, we are led to infer that the Kermadec volcanoes will be of about the same age. It would be at that time, in all probability, that the great fissure, or fracture in the earth's surface, was first formed, or re-opened, and a period of great volcanic activity set in, which has continued in a decreasing degree to the present time.

The islands being wholly volcanic, we cannot expect the assistance of fossils in determining their age. It seems unlikely that any such should be found so near volcanic rents; but I wish to mention—more as a hint to future visitors than anything else—that Mr. Bell told me he had found a fossil *kukuroroa*, or great mussel of New Zealand, embedded in a mass of pumiceous tuff which had fallen from the cliffs on the east coast of Sunday Island. The finding was related with such circumstantiality that I can scarce doubt the fact, though I searched half a day in the locality without seeing anything of it.

In stating that the islands date from Eocene times, it should be understood that this was the age when the volcanic forces first commenced to build up on the sea bottom the mountains we now see. Their present shapes are due to much later movements: indeed, some of the surface indications go to prove that alterations have taken place in comparatively quite recent times. Doubtless the first outburst must have been submarine, and ages would elapse before the mountains appeared above the sea-level.

On Sunday Island—which is somewhat triangular in shape and about 20 miles in circumference—we can trace a great deal of the method by which it has been built up. All round the island, except on the north side, can be seen very distinctly a series of lava flows, composed of black and dark-brown andesitic rock, all of which lie nearly horizontally. Separating these flows in a great number of places are bands of red laterite, varying from a few inches up to several feet in width. These bands are interesting as proving that the outbursts of lava were intermittent, and that a sufficient time elapsed between each for land surfaces to form and vegetation to flourish, to be destroyed by the following overflow, and by it to be converted into the laterite we now see. On the northern side the lava flows are hidden by later deposits, which have extended outside them. The rents from which these horizontal lava streams exuded are lost. They probably originated when the island was of larger extent, for I do not think they emanated from the craters whose remains can still be seen. Resting on top of these lavas, somewhat irregularly, are beds of pumiceous tuff of great depth, which are composed principally of a dark coloured pumice, fragments of andesite, obsidian, and other rocks. It is difficult to say whether the whole of these tuffs are the product of the existing craters, but I think not; they are more likely to have been deposited previously to the formation of the craters, which have since burst through them.

There are two distinct craters to be seen on the island, besides a smaller one of quite recent date, and probably a third one existed, the remains of which are to be traced in the Herald Islets, the lava flows and pumiceous tuffs of which all have a uniform dip in a direction differing from that of the great crater itself. The oldest of these is only in part remaining. The almost perpendicular cliffs of Denham Bay form half of the old encircling rim, the other half having been washed away by the action of the sea; but even here the volcanic forces are not yet extinct: there are still a few fumaroles on the eastern side, at the foot of the cliffs, sending forth a little steam; and not more than fifteen years ago the old crater showed signs of somewhat remarkable activity, of which I have obtained the following evidence.

The first settlers lived on the flat in Denham Bay; they left in 1847, being frightened by the earthquakes and signs of a coming eruption. The next settler, Mr. Cook, of the Bay of Islands, left in 1858, being also frightened away by an expected eruption. In 1872 occurred the eruption in the other great crater, to be referred to later on, and at this same date also occurred an eruption in the Denham Bay crater. As the people then living there escaped in a whaler at the first sign of the outburst, we have no very definite particulars, but this much is certain, that an island was thrown up in Denham Bay, of size sufficient to form a shelter to vessels anchoring under its lee. It was landed on by Captain Hoosier, one of the whaling captains, and by Reed, lately an officer of the notorious *Petrel*, and was described by them as being formed of sand and stones, quite hot to the feet. Mr. Cook, who was there again in 1877, describes it as a "mountain of sand;" but at the date of his visit it had become a shoal. Lord George Campbell, an officer of the *Challenger*, heard from the whalers at Tonga, in 1874, that an island had been thrown up south-west of the group, doubtless referring to this; and further evidence of it is to be found in the presence of the Wolverine rock, or shoal, on which there is only 1½ fathoms of water, and over which the sea breaks heavily even in ordinary weather. This rock was certainly not in existence when Captain Denham made his exhaustive and excellent survey in 1854, or he could not have failed to see it. Cook also mentions that the lagoon on the flat had "been exhausted" (*i.e.*, dried up) when he was there in 1877. At the present time the only signs of activity are a few fumaroles at the base of the cliff, and which lie in a direct line between Denham Bay crater and the great crater of Sunday Island. The walls of this old crater are most distinctly seen in Denham Bay to be built up of successive lava flows, capped by the pumiceous tuffs on top; and so steep are they, that access to the summit is only to be found in one place where a rugged footway has been formed by the settlers.

Lying immediately to the east of the crater I have described, and separated from it by a narrow ridge, varying from about 800 to 1,500 feet in height, is the great crater of Sunday Island. This has a length of 1¾ miles, with a breadth of 1¼ miles from rim to rim, and is, taken altogether, a very perfect specimen of its kind. The internal slope of its sides is exceedingly steep, indeed in many places it is quite inaccessible where not covered with vegetation. The peak called Moumoukai, on its eastern side, is 1,728 feet above sea-level; and as the lake in the bottom is but 40 feet above the sea, it will be seen that the crater is of great depth. On the north side, however, the encircling rim is much lower; one point, in a gap or break in the ridge, being only 180 feet above sea-level. At the present time the sides are generally covered with vegetation, though here and there are bare places, causedby the destruction of the trees during the eruption in 1872.

The crater lake in the bottom is fresh water, and just one-third of a mile in diameter, and nearly circular in shape. Captain Denham's chart shows two little islets in it, but these are now submerged, and only the dead tree-tops are to be seen appearing above the water. The chart also shows a smaller lake, about a quarter of a mile to the south of the other one, and this at that time was surrounded by a ring of hills of no great elevation, denoting a crater rim. It was in this little crator that the eruption of 1872 took place, and which drove away the then inhabitants of the island—a man named Covat, who, with his family, escaped in a whaler to Fiji. When we come to consider the size and depth of this great crater, it will be seen how much material has been removed by that all-powerful agent steam. If I am right in supposing the horizontal lava flows, seen in the cliffs of the island, to be more ancient than either of the craters to which reference has been made, it follows that these solid beds have been removed altogether, and have been scattered in fragments far and wide, whilst much of the pumiceous matter ejected has also disappeared by the gradual washing away of the shores of the island. In the fertile flats on the north coast of the island, elevated 200 feet above the sea, we find part of the remains of this ejected matter, which must at one time have extended far beyond its present bounds. These flats are formed of horizontal beds of pumice, andesitic and obsidian fragments, all of which are easily acted on by the waves and the weather. No lava streams can be traced as originating from the crater; but in more than one place on the north and east coast of the islands there are dykes of very large size formed of andesite, and these appear to have been forced through the pumiceous tuffs. They are of somewhat different composition to the horizontal augite-andesite lava flows described.

In Meyer Island there are several such dykes to be seen, but they are here very much smaller, more regular, and stand up above the surface like broken walls; they are also andesitic in composition.

After the great crater had ceased its activity, the smaller one within it, which is shown on Denham's chart, appears to have been formed on its bottom. The chart of 1854 shows this as a small circular lake within a ring of hills. From all the information I have been enabled to gather, there was no sign of activity displayed at the time of Captain Denham's survey. The great crater bottom was at that time, and for long after, covered with pohutukawa and nikau palms; and the soil has been described as of very great richness. The little crater had apparently died out and become extinct.

Sterndale, who passed some days on Sunday Island in 1869, makes no mention of volcanic or thermal action as then to be seen, and so observant a man would certainly have done so had there been any sign of such; but in September, 1872, he visited the place again, and then says: "In the early part of 1872, the water in the little freshwater lake on Sunday Island began to boil furiously, which was followed by a column of fire spouting up from the middle of it. A whale ship in the neighbourhood, seeing the flame, bore up, and took off Covat and his family. . . . In September, 1872, I landed there. . . . I found no one, and the place was much scorched towards the interior. All signs of volcanic disturbance had disappeared, with the exception of the dead trees on the hill-sides surrounding the little lake, and some black cinders and ashes which were strewn about the margin."

The island was without permanent inhabitants until 1878, when Mr. Bell took up his residence there, so that we have no record as to whether there was any eruption subsequent to that of 1872. Our fellow-townsman, Dr. Stockwell, spent three days on the island in October, 1876, and he tells me that the larger lake was at that time of quite a different shape to what it is shown on Denham's chart, and to what it is now. It had then somewhat of a serpentine shape, the banks were covered with mud, and altogether it was of smaller size than at present. A little vegetation was seen on the southern walls of the great crater; but in a direct line from the little crater, (or as it is now called, the Green Lake,) towards Bell's homestead, there was no sign of vegetation, nothing but bare consolidated mud and fragments of rock. This belt was about a quarter of a mile wide. The walls of the great crater, on the east and north-east sides, had not been affected by the mud thrown out so copiously, but in the other parts there was a good deal of it scattered about. At the present time this belt of mud is so thickly covered with vegetation that nearly all signs of the eruption have disappeared.

It is far different, however, at the bottom of the great crater in the neighbourhood of the Green Lake. When the outburst took place, the mass of ejected mud, pumice, and rock broke away the encircling ring of hills, and poured down into the larger lake, partly filling it, and for a time raised its waters some 10 feet higher than it is at present, as may plainly be seen by the blocks of pumice stranded some way back from its margin. At the same time a great mass of mud and fragments of rock were ejected in all directions from the little crater, destroying the vegetation, some of it falling on the southern side of the greater crater within which the Green Lake lies, and there, in its descent, bringing down all the trees, and leaving the cliffs bare, as they still are in some places at the present day. The depth of this deposit is about 12 feet around the rim of the crater, and through it are protruding the stumps of the pohutukawa trees killed at the time of the outburst. The last material to be ejected from the crater was pumice, in blocks of all sizes from an inch to 2 feet in diameter; and this was apparently not cast out with sufficient force to overtop the crater rim, for it is confined to a level bed rising about 10 feet above the level of the water, and surrounds the lake as a raised beach. Amongst the matter ejected are quite a number of vomited masses of molten andesite, very like pitch-stone in appearance, as large as small oranges. At the present time steam at a temperature of 185° escapes from two or three places within the crater rim, but no hot-water is found. There is a somewhat singular cave on the east side, from the floor of which the steam arises in sufficient quantities to make it unpleasantly warm, and on the sides of which is deposited a considerable amount of soft white matter not unlike gypsum.

It is remarkable that there was a considerable falling-off in the volume of steam from these places in the week following the Tarawera eruption, as observed by the Bell family. Mr. Bell assured me that the place is now not nearly so active as it was prior to June, 1886, and this fact affords further evidence of the connection between New Zealand and Tonga, along the fissure I have attempted to describe.

The land surrounding the Green Lake presents a very desolate appearance, covered as it is with hard mud, pumice, obsidian, and fragments of andesite; but the pohutukawa and Kermadec ngaio are gradually gaining a hold on it, and in a few years' time will have obliterated all signs of the eruption. It is noticeable that the stumps of the trees still protruding above the mud are nowhere of any size, thus probably indicating that the eruption of 1872 was not the first one in that locality which was sufficiently serious to destroy the vegetation.

Although the eruption of 1872 is the latest which has occurred on Sunday Island, a disturbance of much more recent date took place in its neighbourhood. Mr. Bell informed me that in March, 1886, (just three months before the Tarawera eruption,) he left the island in the whaler *Othello*, Captain Earle, for New Zealand. When 5 miles north of Sunday Island, they sailed for some time through a great mass of floating pumice, which was estimated to be 8 miles long by 1½ in width. This was observed to be rising up from the bottom and spreading out from the centre of the mass. Evidently this was a submarine eruption, though no steam or other evidence of it was observed.

The only signs of volcanic activity at present observable on Sunday Island are those I have mentioned—viz., a few small fumaroles in Denham Bay, some equally insignificant escapes of steam from the Green Lake crater, and an outflow of hot-water below high water-mark on the northern beach. The whole island is covered with a dense vegetation of trees and ferns, excepting in the immediate neighbourhood of the Green Lake.

At 68 miles S.S.W. from Sunday Island is MACAULAY ISLAND, which is roughly circular in shape, and about a mile and a third in diameter.

The highest point is at the western end, where a rounded hill, 781 feet in height, with steep nearly perpendicular cliffs on the seaside, marks the position of an old volcano. The island is surrounded on all sides by perpendicular cliffs, varying in height from 200 to 500 feet, and the surface is covered with a smooth sward of grass. These cliffs afford a means of studying its structure much better than in the case of Sunday Island. It is clearly seen to be the remains of a volcanic mountain, the western half of which has disappeared by denudation. The old neck or throat of the volcano is still to be traced in the solid lava of the western cliffs, from whence the various beds that form the island slope away to the east in regular series. The lowest seen is a hard andesitic lava, which forms the base at the sea-level all round the island, and which has flowed from the volcano at the west end. Above it comes a deep bed of light-coloured pumiceous tuff, full of blocks of pumice, obsidian, and fragments of andesite for a depth of about 200 feet. This bed of pumice, etc., was the last ejected from the old volcano. Subsequently—but after what space of time no one can tell—a change took place in the locus of activity. Another and much smaller crater was formed on the east side of the old one, the outline of which is still quite distinct though it is imperfect in shape, the eastern side having been nearly all carried away. The matter first ejected from it was a series of andesitic lava flows, of no great extent, which spread out in different directions as they rolled down the slopes of the older mountain, following in several instances the pre-existing gullies, and in one case falling over the edge of the pumiceous cliff underneath in a lava cascade, which now forms the only accessible ascent to the top of the island from the beach below. In other cases the lava streams are seen to fill up crevasses and hollows in the underlying pumice, conforming to the undulations of its surface. This lava appears to have been in a very liquid form, for it is nowhere more than a few feet thick, and has run along slopes which have a very gentle inclination. Following the lava was an ejection of black and dark-brown vesicular scoria, very much like in outward appearance that seen in any of the cones around Auckland, but differing somewhat from it. The presence of olivine crystals in it shows, however, that the scoria is basaltic. The scoria is deposited much deeper around the little crater from which it emanated, and thins off from there towards the eastern and lower parts of the island, being perhaps 100 feet deep near the crater, and 2 to 4 feet on the lower ground. Finally, following the scoria, an eruption of mud or fine ash of a dark-brown colour took place, and this forms the not unfertile soil of the island; it is about 4 feet deep.

To the east of Macaulay Island, and separated from it by a narrow passage is HASZARD ISLET, which is formed of the same lava and tuff as the larger island, but the scoria has not extended so far. But here the inclination of the beds is in the opposite direction, denoting that a partial subsidence has taken place along the line occupied by the passage, which is probably a fault. Viewed from any direction, Macaulay Island presents a pleasant appearance; the gentle undulations of the surface, covered as they are with a close sward of green grass, would form an attractive feature to the agriculturist were the island situated near our own coast. Landing on its rock-bound shores is very difficult, except in one place, and with favourable weather, under the shelter of Haszard Islet, where a little sandy bay is found.

It is doubtful whether there is permanent water to be found; we saw none but a little in some rocky pools, and that was after a recent heavy rain.

Twenty-two miles south of Macaulay Island are the CURTIS ISLANDS, separated from one another by a deep channel a quarter of a mile wide.

The eastern island is much the largest and most interesting of the two, for here we have a crater much more active than those on the other islands; though this is in what is called the solfatara stage. The island appears to be formed of massive lava, standing up out of the sea in perpendicular or overhanging cliffs for a height of 500 feet. The crater is situated on the north side, and is formed by a deep hollow in the massive rocks, with almost perpendicular sides all round, excepting on the north, where the sea enters by a little cove, the only landing-place on the island. The floor of the crater is about 15 feet above the sea-level, and scattered over its surface are a number of solfataras, fumaroles, boiling mud holes, and heaps of sulphurous mud. A strong stream of very hot water runs out of the crater into the cove, the salt waters of which are warmed by it for some distance from the shore. There is a considerable amount of activity displayed by the numerous fumaroles, the steam rising, perhaps, a hundred feet from some of them, with the usual accompaniment of noise so common in the Rotorua District. Many of the boiling mud-holes are of considerable size, and their contents are seething and twirling about, just as we see those at Tikitere, at Rotorua, and other places in that district. Our visit to the crater was so very brief that I was unable to procure any rock specimens, all our attention having been given to exploring the crater, and viewing the various fumaroles. We had intended to make a complete examination of the island on the following morning, but bad weather coming on we were obliged to leave without doing so. I regret this the more, as I believe the rocks are not formed of the same andesite common to Sunday and Macaulay Islands; they have more the appearance of trachytic rocks from a distance. As we passed round the island, steam was observed to be escaping from several places in small quantities from the outside cliffs. Curtis Island is a mere crater rim, or chimney top, standing up above the sea-level, and on which scarcely any vegetation is to be seen. It has somewhat the same features as White Island, in the Bay of Plenty, but is on a smaller scale.

The last island of the group is L'ESPERANCE, or French, or Brind, Rock. It is situated 52 miles southerly from Curtis Islands, and is—as its name suggests—a mere rock standing in the solitary waste of waters. It is, like the others, of igneous origin, but as we were unable to land I cannot say what the rocks are composed of. The height is about 280 feet, and length 280 yards. A somewhat remarkable feature in it is a crater-like or cavernous hollow on the eastern side. The rocks of which it is composed look like the augite-andesite lavas of Sunday Island; but there are two distinct kinds, the second being a reddish scoriaceous one, which appears as if it had been ejected from the crater-like hollow, and had subsequently become consolidated and bound together by some cementing matter. There is a little vegetation on the rock, apparently the ice-plant common on the larger islands.

It will thus be seen, from the imperfect description I have given of the group, that nothing but igneous rocks are met with, and that these (with one exception) belong to the basic, or, rather, the transition from the acidic to the basic, class of volcanic ejecta. The exception is a rock found on Sunday Island as boulders, on the north and east sides, which the microscope shows to be syenite, one of the plutonic rocks. Its presence can only be explained by the supposition that it has been brought up from great depths by volcanic agency, just as has been the case at Tarawera. It is only found in smooth rounded boulders on the beach, and then in no great quantities; but still there is enough to preclude the idea that these have been brought there by the hand of man.

With the exception of this syenite, the islands afford no support to the theory that a continent, now submerged, extended formerly in this direction, and on to the other islands of the Pacific—at any rate within the more recent geological periods—and by which means our fauna and flora travelled down from the north. If ever such land connection existed, it must have been in very ancient times, probably long before the dawn of the Tertiary period. The solution of the problem as to how the present flora and fauna of the islands became domiciled there must be left to other hands than mine to deal with; I will merely point out that the presence of kauri logs which can be traced to our northern rivers, together with all the facts we know with respect to the currents between there and New Zealand, suggest some thoughts as to their origin that are worthy of attentive study.

In conclusion, I beg to tender my sincere thanks to our President, Professor Thomas, for the great trouble he has taken in the microscopical examination and naming of the rock specimens brought from the Kermadec Islands.

Art. XLIV.—*Minerals at Nelson.*

By H. P. Washbourne.

[*Read before the Nelson Philosophical Society, 6th February,* 1888.]

In the Nelson District we have but little agricultural land, but we have an immense tract of mineral land, of the value of which we have not, as yet, any idea. If we are to prosper, it must be by the development of mining and manufactures; and for both of these industries we have natural advantages, if we will only make use of them. The day is past when we could by the primitive means of dish, cradle, or sluice-box, take out of the creeks and gullies the gold, which the action of air and water had separated from the matrix, and concentrated there. We have now to win the minerals from their lodes, and we must study the best way to discover these, and extract the valuable metals economically when they are found. If I can contribute anything about this matter that will interest you, I am sure I shall be very happy to do so; and if it only has the effect of directing attention to some of the more obscure forms of the valuable metals existing in our district it will serve a useful purpose.

The subject is such an extensive one, that it is difficult to know where to begin: and perhaps I cannot do better than first show you some ores, giving some particulars about them which will illustrate the usefulness of a School of Mines, and, secondly, the need of a central reduction works, and the natural capabilities of the Nelson District for such an establishment.

The first piece of ore I will show you really belongs to the order of grey copper ores, but having such a high percentage of silver is called a silver ore. It comes from Richmond Hill, Collingwood, and was named by Dr. Hector "Richmondite," as it was a new form of grey copper. From the analysis made at the Government Laboratory, Wellington, this ore is composed of the following eight minerals:—

Sulphides of Lead	36·12
Antimony	22·20
Bismuth	Traces
Copper	19·31
Iron	13·59
Zinc	5.87
Silver	2·39 (390 oz.)
Manganese	·52
	100·00

This was taking the average across the vein: but some of it assayed as high as 1,792 oz. of silver to the ton. The ore occurs in a gneiss rock, the adjoining rocks being all of a silver-bearing character; and if we geologically compare Richmond Hill with the principal silver-bearing districts of the world, we shall be surprised how similar it is, in the most essential particulars. We have here a class of country peculiarly silver bearing, in whatever part of the world it may be found; and we have also very rich specimens of silver, nickel, and associated minerals found in this class of country. Nature has done much in thus showing us the strong indications of hidden wealth: but we lack the capital, the energy, and knowledge of its value to follow it up. Gold in its metallic state has more attraction for the public. It is more simple; for when the stone is crushed the product is readily saleable anywhere. It has, moreover, been first in the field, and has attracted public attention to the exclusion of nearly all other minerals. In California the grand silver deposits were passed over for years, and the dull, unattractive-looking ore was thrown by as worthless in the search after gold. Thousands passed over it, little thinking of the wealth they were treading under foot. May we not be doing the same thing now? If we consider that there are about seventeen varieties of silver ore, totally different in appearance from each other; that the silver may be in one or several of these forms in the same lode; that it may occur as a valuable constituent of the ore of any other mineral; and that, by the action of air or water, all or any of these may alter their chemical nature and appearance altogether, we shall not be surprised that valuable silver deposits are often overlooked and neglected.

The specimen of richmondite you have just seen shows how silver may be combined with other minerals. It is a very rich specimen of silver ore, yet the proportion of silver is only 2·39, to 97·61 of other minerals; but, under favourable circumstances, a tenth, or less, of this percentage would make a valuable silver mine.

I will now show you some silver buttons that I obtained some years ago from 200 grains of the richmondite. They represent from 260 ozs. to 770 ozs. to the ton of ore.

I will next show you some silver ore that does not belong to New Zealand, but comes from the "Sunny Corner," New South Wales, from a mine that produced 4¼ tons of refined silver in three months. If you compare it with this second specimen you will see that there is not much in its appearance to show that it is a valuable silver ore, while the other is only a worthless piece of ironstone; yet analysis shows this to be the case.

Scattered all over our country is material similar in appearance to those specimens you have just seen; and the great question we want to solve is: Are they all worthless? or do some of them, like the "Sunny Corner," contain valuable metals, in an obscure form, hidden within them? The only way to ascertain this is to have them analysed, and this should be done free—that is, at the country's expense—as all the people of New Zealand will reap the benefit of any discovery that is made. Many do not take into consideration how much our interests as a community are bound together, and think that having assays made free would be giving a direct benefit to miners only. This is a short-sighted view to take! The miner or explorer, by expense, labour, and hardship in searching for and carrying specimens over miles of weary hill and dale, quite earns any extra benefit he may get through having assays made free. As showing the difficulties often attending the collection of specimens, I will mention a case which occurred to a friend and myself five or six years ago. We had a long trip over some of the roughest mountains between Nelson and the West Coast, and had collected specimens of rocks, minerals, etc., on our way. After carrying these twelve hours a day for nearly three weeks, we had to throw them away to lighten our loads, and push on for food, as we had nothing whatever to eat, and had had but very little for the previous four days. We were not out looking for minerals, but took them in our way, and should not have felt inclined to pay several pounds to have had them assayed if we had brought them in, although we certainly should have had them analysed if free of cost, and the information might have been of value to the country, if not to us particularly. I feel sure some of the country we crossed is tin-bearing; and if the specimens from there showed the presence of tin, they would, by proving that valuable mineral to exist there, have induced prospectors to search for the lode containing it.

The next specimen for you to see is from the "Union" mine, in the Waihi District, and contains gold and silver to the value of about £48 per ton. I will quote what Professor Black says of these ores, as it clearly shows a need of analytical knowledge in finding them, and a metallurgical knowledge to work them successfully. In his report, he says:—"Most of the gold also in the silver-bearing ore exists as a blackish sulphide of gold, probably in combination with the sulphide of silver, and thus escapes the notice of the miner who is prospecting on the old lines. It is only when gold and silver are brought out, either by the fire assay process, or by the wet chemical processes, that the value of the stone is known. Much of the stone on the Waihi and Karangahake, containing gold and silver worth from £10 to £100 per ton of stone, has been overlooked for want of a little of this kind of knowledge." You will notice there is nothing attractive-looking about that piece of stone, and few would give a second glance at it. Yet those dark patches are rich in gold and silver, although not in the bright particles we expect to see them.

The next specimen I have to show you is from Te Aroha, the southern extremity of the Thames Goldfield. The mines here are situated about two-thirds up the mountain of Te Aroha, and the expense of getting stone from the mines to the battery at Waiorongomai, together with the loss of gold by the ordinary process of treating the stone, has prevented this field paying as well as it should. The dark portions of the stone are the rich ones; and a strong magnifying glass will show that the discoloration is mainly caused by fine particles of gold, which, like all the gold in this district, is very much alloyed with silver. These specimens show that, although "all is not gold that glitters," still a great deal that does not glitter *may* be gold, and that we cannot from its appearance judge of the value of an ore. It may be thought that I lay too much stress on the necessity of assays being made free of cost: but consider the vast extent of mineral country that we have; the difficulties of travelling and searching for minerals, from the roughness of the country, and the growth on it; and it will be seen that the few men who are engaged professionally prospecting for them are like drops of water in the ocean. They have their effect, but it is very slight. These cannot afford to pay to have assays made of every mineral they may find, so confine their prospecting to the more easily recognised gold. By having assays made free, not only are these encouraged to search for other minerals, but it developes another class of amateur geologists, so to call them, who are interested in knowing what any ore they may find contains. This class greatly increases the number of explorers and searchers, and some of the most valuable mineral deposits have been discovered through them. Davies, in his "Metalliferous Minerals and Mining," says: "As a matter of experience, we have seen that many of the richest mines have been discovered by accident: the wayfarer, resting in the wilds of the Saxon forest; or the muleteer, in scrambling after his mule in Brazil. The curiosity excited by the great weight of the stone in California Gulch led to the discovery of carbonate of lead." These are a few examples of what at first sight seems to be the accidental discovery of mines. But such discoveries were accidental only by reason of the previous ignorance or indifference of the dwellers in the land; for in each of the above illustrations there were natural indications which would make it plain to intelligent seekers that valuable minerals were near. The establishment of a School of Mines would greatly assist in removing ignorance and indifference; for with more knowledge would come greater interest, and to *young* men especially such instruction must be useful. I believe it would give to mining a truer and higher tone than it has at present, when miners are miners if it enables scrip-holders to sell their scrip at a fictitious value; and the study of scrip-holders now is not so much what is best for the mine, as what will enable them to sell their scrip at a profit. This degrades mining from an honest speculation to a kind of fraudulent gambling, very injurious to the mining industry.

Before entering upon the advantages we possess in the Nelson District for treating ores which require to be smelted to obtain the valuable metals they contain, it may be as well to show what is required to do so successfully. Briefly, we may say that these are accessibility, cheap fuel, flux, and power. We can get an instructive lesson from La Monte's smelting at the Thames last year, which, although a failure—in so far that it did not do what he stated that it would—shows forcibly several causes of failure. La Monte engaged to save 90 per cent. of the gold and silver in the ore, at a cost of £2 per ton; but he did not succeed in saving that percentage, and it cost £6 15s. per ton for treatment. Possibly La Monte had been used to ores which contained the necessary flux in themselves, and he did not calculate the cost and quantity that the quartz ores he had to treat would require; hence we find that for flux alone the cost came to nearly 30s. per ton of ore, out of the 40s. for which he was to treat it; and even then he did not use enough to save the percentage he engaged to do. The proportion of ore to flux and fuel in such ores may be taken roughly as one to three; so that it is cheaper to take the ore to the flux and fuel than the reverse.

At the Parapara, Collingwood, there are immense deposits of ironstone and crystalline limestone, both of first-class quality. They are close to deep water in a very central position, bordering on the Straits, and so in the line of vessels; fuel and water-power are cheaply and easily obtainable. If we take the cost of flux and fuel at the Thames for the 181 tons of ore treated there, and compare it with the cost of the same quantities at the Parapara, we shall see what a difference there would be in the cost of treatment. I take the following quantities and prices for the Thames from the report of the Directors:—

THAMES.

	Tons.			£	s.	d.
Iron Ore	320	at	15/- ..	240	0	0
Lime ..	59	,,	7/6 ..	22	2	6
Grey Coke	56	,,	59/- ..	165	4	0
Gas Coke	61	,,	26/- ..	81	3	0
Coal ..	15	,,	31/6 ..	22	12	6
				£531	2	0

PARAPARA.

	Tons.			£	s.	d.
Iron Ore	320	at	2/6 ..	40	0	0
Lime ..	59	,,	2/6 ..	7	7	6
Grey Coke	56	,,	40/- ..	112	0	0
Gas Coke	61	,,	23/- ..	70	3	0
Coal ..	15	,,	10/- ..	7	10	0
				£237	0	6

A difference of £294, less the freight on the ore from the Thames to Parapara.

A great consideration in favour of having one central establishment where the materials required are cheaply obtained is, that the necessary appliances, skilled labour, and knowledge can be concentrated to treat any and all ores. This cannot be done with small scattered ones about the country; and the cost of treatment in the former would be much less per ton, besides the fact that the mixing of different ores is often necessary and generally beneficial. The opening of reduction works in a position available to all New Zealand, as this would be, would have a very useful and encouraging effect on mining. Ores of all kinds would then have a marketable value, and it would do away with the present uncertainty of the working value of an ore. The length of time a mine may last is too uncertain to warrant the expenditure necessary for treating the ores economically; and, although a mine may have a few or even a good many tons of good ore to treat, it is necessary that there should be a very large quantity proved before erecting furnaces, etc. The consequence of this is that much valuable ore is lost, because it is scattered about the country, a few tons here and a few tons there, not sufficient in any one place to put up the costly plant for, but which could be brought to a central establishment if such existed. A central reduction works would also have the advantage of not being dependent on any one mine, so that if some failed, others would be coming forward.

We know there is a great waste of gold from our quartz batteries, amounting to thousands of pounds annually. If the gold, etc., could be extracted at a reasonable price, or if the ore had a market value of so much per cent. of the assay value, mine proprietors would soon and without much expense concentrate their tailings, until they contained a high percentage of bullion. This could then be treated or sold, and the product would add very considerably to the returns from many of the mines, and would make ground payable that is not so now on account of the loss of metal.

In the case of the Champion Copper Company, I think perhaps it would have answered their purpose better to have put up their smelting works at Parapara instead of at the mine, where they have to carry fuel and flux up, and then the copper down. Certainly, if there had been smelting works at the Parapara it would have made a great difference to them; for they could then have gone on proving their mine, and getting returns by sending their ore there to be smelted; and, if there had not been much profit while proving their mine, there would not have been much loss, and the proving would have been thorough. Now, after spending so much on machinery, they have a very promising but unproved mine; and the value of the plant depends entirely on the success of that one mine. The erection of the necessary works in a position so peculiarly adapted by Nature for economically treating ores would give a great impetus to mining, by enabling mine proprietors to get the working value of their product, and some return for their outlay while the work of prospecting was proceeding. It would lead to new lodes being found; some of those now abandoned being prospected and worked; and prevent the rash expenditure for machinery (in the expectation of early dividends) of money that should be spent in the ground. Thousands of pounds every year are completely thrown away in this manner, and mines abandoned—not because they have been proved worthless, but because all the money has been spent in machinery to treat ores that they have not the money left to win. The rich veins that will pay with the present wasteful treatment are few, compared to the poorer ones that would be remunerative with a proper system; and it is these that form the bulk of our mineral wealth. For instance, with quartz reefs, if we could not make less than 1 oz. of gold to the ton pay, the number of mines worked would be very few, we will say five; if ½ oz., perhaps twenty; but if a ¼ oz. could be made to pay, the proportionate number would be raised to 100. In minerals other than gold this is still more the case, as there are a number of elements for profit or loss, and it requires more knowledge and skill to make it a profit. Money, labour, and skill are expended to mine ores from the earth, and then they are treated in such a way that perhaps the greater percentage of the metal for which they were mined is lost.

The feeling of uncertainty as to what to do with an ore, if found, causes many good indications to be neglected. In Great Britain, nickel ore is worked at an average of 2·8 per cent. of nickel; in Spain, at 8·96; in Canada, a 9-inch deposit, at from 3 to 4 per cent.; and in Connecticut, a 12-inch vein, with a percentage of 2·2. The greater proportion of the nickel of commerce is derived from pyrrhotine. Yet on the Richmond Hill lease there is a vein larger than those mentioned, which, on the surface, gives 2·98 per cent. of nickel—and this has not excited enough interest even to cause it to be prospected. Mr. S. H. Cox says of this vein: "As nickel is extracted from this ore in New Jersey, United States, when only 3 per cent. is present, this should prove payable, if the lode is continuous and sufficiently large." I mention this case, as it is characteristic of many others that will lie dormant until means are provided for their proper economical treatment in the Colony.

Briefly, the advantages of such works to mining would be that much valuable mineral now thrown away would be profitably saved; many mines, abandoned or undeveloped, would be prospected and profitably worked; and large sums of money now wasted for machinery on unproved mines would be saved.

I believe that smelting works would be a good investment, and could be profitably worked at the Parapara, if the requisite capital and knowledge were brought to bear on it. If the proprietors either treated the ore for so much per ton, or, perhaps still better, bought the various ores, giving such a percentage of the assay value as left them a sufficient margin of profit, a supply of ores would soon spring up, and they would practically have a monopoly of the business; for, as they could treat ores more cheaply than elsewhere, so they could give a better price for them. In many cases the by-products would of themselves give a good profit. The richmondite—even if we do not reckon the 36 per cent. of lead, or the 22 per cent. of antimony—is a good copper ore, and its 19 per cent. of copper should be a good product, in addition to the silver.

As most of the ores they would have to treat in New Zealand would be sulphides, they should be able to make sulphuric acid in treating them. This is an article much used for artificial manures and other purposes; and the colonial manufacture would have an advantage from the difficulty of transporting it. In England they import sulphide of iron from Spain for the sole purpose of making this acid from it. But in the Parapara District, sulphide of iron, containing from ½ dwt. up to as high as 3 to 4 ozs. of gold per ton, is plentiful; and I believe sulphuric acid could be made in quantity at a less cost there, than as at present, from the limited and precarious supply of sulphur from the volcanic region of the North Island.

We cannot afford to waste several valuable constituents of an ore, and mining will not progress in a satisfactory manner while we do. I believe that, by having the means of getting ores economically and properly treated in New Zealand, we would cause an interest in genuine mining highly beneficial to the whole Colony, and, if properly conducted, it would be a profitable investment. We have all the natural advantages for doing this in the Nelson District, if they were only utilised, and a first step towards this, I consider, is to make those advantages known.

IV.—MISCELLANEOUS.

ART. XLV.—*Ancient Alphabets in Polynesia.*

By E. TREGEAR, F.R.G.S.

[*Read before the Wellington Philosophical Society*, 10*th August*, 1887.]

Plate XX.

NEW ZEALAND possesses few relics of archæological interest, and fewer still remains of what may be considered as inscriptions. The pictures in the cave of the Weka Pass,* and other cave-paintings, are mere rude pictures, in which, apparently, there has been no effort to produce anything beyond mere representation, and not rising even to the rank of picture-writing. Further investigation and study of these drawings may evolve hidden meanings in some of the smaller marks, but at present there is no light on the subject. In other parts of the Pacific inhabited by the fair Polynesians there are many localities worthy of the study of the archæologist. The "Stonehenge" remains in the Tonga Islands; the pyramids of Tahiti; the wide paved platforms of the Marquesas; the great carved images of Easter Island; the stone temples of the Sandwich Islands: all these are full of interest. But the inscriptions are as yet undiscovered, or they have not as yet been brought to the knowledge of inquirers. Easter Island, with its well-known carved tablets of wood, marked with the incised forms of curious hieroglyphics, which have taxed the learning and ingenuity of many wise men fruitlessly, is the only place where anything like an alphabetical or hieroglyphical system of writing has come to light.

On Pitcairn Island is a rock-inscription in picture-writing. A copy can be found in "Te Ika a Maui."† To its faithfulness I can testify, having received an original drawing of the inscription, similar in every way to that in "Te Ika;" and I was furnished with additional particulars not mentioned by Mr. Taylor. The incisions are deeply cut into a very hard rock, of the kind generally known as the "French whin," situated near the base of a steep cliff, the foot of which is beaten by the sea, and the cliff is only descended at the risk of life. There seems to be no reasonable doubt as to the authenticity of the carving: the symbols are common to the religions of the ancient world, and are scarcely likely to have been sculptured in such a place by Europeans, castaways or others, although there is reason to suppose that subsidence of the island has taken place. Large tanks or cisterns hewn out of the solid rock, and other traces of long ago occupation, were found by the mutineers of the *Bounty* in taking possession of Pitcairn. But there is nothing in this drawing which can be called aught but picture-writing in its most primitive form.

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* "Trans. N.Z. Inst.," vol. x., p. 52.

† By the Rev. R. Taylor, edit. 1870, p. 702.

Since no inscriptions are available, we may turn to ancient alphabets, and see if any trace of them exists in the living record, *i.e.*, the language of the people. The letters in ancient alphabets bear plain evidence of their picture-writing birth, in the names by which they are called. Thus *A* was not called *a* but *aleph*, that is "the ox;" *B* was not called *b* but *beth*, "a house." The researches of antiquarians have demonstrated the theory that the art of writing began with the Egyptians, passed from them to the Semitic nations (Hebrews, Arabs, etc.,) and was adopted from the Semites by the Aryan Greeks and Latins. Picture-writing preceded the alphabet, and the hieroglyph was the mother of the letter. The Aryans nowhere seem to have invented an alphabet for themselves; they always took over borrowed forms from peoples of earlier civilization: the "Ogham" writing of the Irish is comparatively a modern script, and remained only locally known. It consisted of strokes drawn on either side of a centre line, according to the value of the letter represented, and is supposed to have been originally copied from a tree-branch with leaves on each side. A decisive proof that the Greeks took over the names of the letters, as well as their forms, is that *alpha*, *beta*, etc., are meaningless in Greek, but translatable in Hebrew: the *alpha*, our *a*, having still the old resemblance to the head of the ox (*aleph*), reversed ∀.[*]

I propose to take three letters or signs, as examples of the others, and to show that if the Maoris (*i.e.*, Polynesians) did not call letters by these names, they had similar names for the things by which these letters were known. In the ancient world there was far greater activity and intercommunication of peoples than is generally believed. The wide distribution of jade (greenstone) as ornaments, and of the tin necessary for the production of bronze, (both tin and jade being found in few places,) give proofs of widely extended travel and perhaps of commerce. The three letters in question are *k*, *f*, and *t*.

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[*] The derivation of the Sanscrit word *lipi*, "writing," as Dr. Burnell ("South Indian Palæography") has pointed out, is not decisively known. The derivations from *likh*, "to scratch," or *lip*, "to smear," do not satisfy scholars: *lipi* has been best connected with the Achæmenian word *dipi*, "writing, edict." As the first Sanscrit writing seems to have been incised, as in the rock inscription of Asoka, I believe we have the first, or very early, form in the primitive and ancient Polynesian word, found in Maori as *ripi*, "to cut;" and in compounds, *maripi*, "a knife;" *koripi*, "to cut;" in Hawaiian, *lipi*, meaning "an axe," and "sharp"—*cf.* (Eng.) *rip* "to tear open, cut open;" (Middle Eng.) *ripen*, "to search into, probe;" (Swed. and Norweg.) *ripa*, "to scratch"; (Danish) *oprippe*, "to rip up."—Skeat, "Etym. Dict."

The Letter "K."

The hieroglyphic system of writing is of immense antiquity, of a time so remote as to be almost beyond our realization. As a script it was beginning to fall into disuse before Moses led the Israelites out of Egypt—that is, before the national birth of the Hebrew people. All the events which, occurring in Palestine, have so affected the history of the world, took place since the hieroglyphic system of "verbal phonograms" passed away; it can scarcely be doubted that this early form of writing originated in Egypt, not later than 8,000 years ago. The Hieroglyphic passed into the Hieratic, and it was this form which was adopted by the Hebrews.

The *k* found in the hieroglyphs is called *kaph*, and is written as a cup or bowl (see Plate XX., fig. 1). In the Hieratic script, *kaph* is written as a hand, with bent or looped fingers (fig. 2); this form merged into the Jewish *kaph*. *Kaph* is usually held to mean "palm of the hand," or, more probably, as Bottcher suggests, "the bent hand." "The form of the Hieratic character in the Papyrus Prisse seems to be decidedly in favour of this explanation, as will be seen by placing the two figures side by side."[*] The Hebrew form (fig. 3) evidently represents the hand and fingers. The Semitic *k*—*i.e.*, *kaph*, "the hand," became the Greek *κ* or *kappa*, early Moabite *kaph* (fig. 4), Nineveh *kaph* (fig. 5), Baal Lebanon *kaph* (fig. 6). The Baal Lebanon inscription was written on bronze fragments, which when discovered were broken up smaller by a peasant, in order that he might ascertain if they were made of gold. The inscription states that: "This vessel of good bronze was offered by a citizen of Carthage to Baal Lebanon, his Lord." The Pelasgic = *κ*, but the Etruscan and Oscan as in fig. 7; the Messapian = fig. 8. These last show resemblance to the *kappa* of the Thera inscriptions. The island of Thera (Santorin) is said to have been the place where Cadmus invented the Greek letters. The island is a long-extinct volcano, but under its ashes inscriptions have been found upon the rocks, and these are supposed to be the oldest Greek inscriptions in the world. One of these (see fig. 9) reads *κριτοφύλου*; not only is the *kappa* turned, but the writing is in the Semitic manner, from right to left. This *kappa* shows how the κ form was derived from the Egyptian Hieratic (fig. 2) through the Hebrew *kaph.*

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[*] "The Alphabet," Taylor, vol. i., p. 172.

Egyptian words showing the connection between "hand" and "cup" (or bowl) are *kaf*, "the hollow of the hand;" *kefa*, "a fist;" *kep*, "the fist;" *kep*, to "seize, catch;" *khep*, "one hand;" *kabti*, "two hands;" *kab*, "libation, liquid;" *kaf*, "to seize; to claw with the hand." If we now compare Polynesian, we shall find the word "cup," and "hand," in its primitive shape and sound. In New Zealand Maori, *kapu** means "the hollow of the hand," "curly," "to close the hand," "to drink out of the hollow of the hand;" *kapukapu*, "to curl," as a wave; *kapunga*, "the palm of the hand;" *kapuranga*, "a handful;" *kapo* "to snatch at," "to catch." This "hollow of the hand" is the primitive "cup," the first bowl from which our early ancestors drank. When the Maori chief was *tapu*, so that no vessel might touch his lips, he held the hollow of his hand, turned upwards, beneath his lip, and the slave poured the liquid into his master's mouth. So the Brahmin in India receives his drink, lest the brass *lotah* should touch his mouth and then be polluted by even the shadow of another.

It will, of course, be objected that, according to the "cut and dried" rule, no one should be allowed to compare a Maori word with an Egyptian or Hebrew one: but there are some words which I believe to be "world-words," and which were of either very wide adoption or else the root-formation of ancient languages is as yet totally misunderstood. "Cup" is one of these, (including the idea of "hand," and "concave,") and with change of the *p*, through *ph*, into *f* and *v*, seems almost universal. The Greek κύπελλον, "a cup;" κύπη, "a cavity," "cavern;" κυμβαλονα, "a cymbal" (from its hollow shape; *cf.* Sanscrit, *khumba*); the Latin *cupa*, "a tub;" *cavea*, "a cavity," "a coop;" *caverna*, "a cavern;" "to make hollow;" Irish *cupan*, *cupa*, *copan*, *copa*, all = cup. Scottish *cuppel*, "a small tub;" Lithuanian *kupka*, "cup;" Breton *kop*, Polish *kubek*, ancient Slav *koupa*, Servian *kupa;* all mean "cup." Scandinavian *kupa*, "a round vase;" Danish *kop*, Swedish *kopp*, French *coupe*, Spanish *kopa*, Italian *coppa*, Icelandic *koppr* = cup. Icelandic *koppr* also means "the eye-socket;" *spé-koppan*, "a dimple in the cheek," *kupa*, "a bowl," *haus-kupa*, "the skull," *kupadr*, "bowl-shaped;" Russian *kopani*, "a cistern;" *kubu*, "an alembic," *kopati*, "to hollow out ground, to form a trench;" Sanscrit *kambi*, "a ladle or spoon;" *kambu*, "a shell;" *kumbhika*, "a small pot or pitcher; *kûpa*, "a well, cave, hollow;" *kûpî*, "a bottle," "the navel;" *kumbhi*, "a pot, or jar." Assyrian *kabutu*,

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* The short *a* of *kapu* is better represented in English letters by *kup-poo* than by *kāh-poo.*

"a goblet," and *kuppu* "a cage" (*i.e.*, coop). Zend *khumba*, "a pot or jar;" Cymric *cwm* (for *cwmb*), "a valley or combe;" Anglo-Saxon *cumb*, "a measure of liquids;" Middle German *kump*, "a vase or cup."

These examples, from Central Asia to Iceland, show a field of vast extent covered by this word to the westward. Let us take up the Polynesian, and carry the same word thousands of miles to the eastward.

Samoan, *'apu*, "a cup or dish made of a leaf." This is really *kapu*, as the apostrophe implies a lost *k*, and is heard as a slight catch or break in the voice; *apulautalo*, "a taro-leaf cup;" *apo*, "to cling to." Rarotongan *kapu*, "a cup;" Mangareva *kapu*, "a cup," "to enclose," "to contain;" Marquesan *kapukapu*, "to take up water with a cup;" Tahitian (also lost *k*) *abu*, "concave, or hollow," as *abu rima*, "the hollow of the hand;" *abu mata*, "the socket of the eye;" *apuroro*, "brain-cup," *i.e.*, the human skull (compare Icelandic above quoted); *apu*, "the shell" of nuts, seeds, etc.; *aapu* (for *kakapu*), "to take up with the hand;" *aabu*, "the shell of nuts," etc.: "to hold out any cup or concave vessel to receive anything." Also, compare *aipu*, "a cup," "a cocoanut-shell used for a cup," with the Tongan *ipu*, "a cup," and the New Zealand Maori *ipu*, "a calabash." This last shows clearly an abraded form of the word. Hawaiian (lost *k*) *apu*. "a cup made of cocoanut-shell for drinking *awa*" (*kava*); *apu*, "a dish or cup of any material;" *aapu*, "to warp or bend," as a board in the sun, "a concave vessel;" *hoo-aapu* (causative and reduplicate = *whaka-kakapu*), "to turn the hollow of the hand upwards;" *aibu*, "a cup;" *aipu*, "a cup," "a cocoanut-shell used as a cup."†

I do not think any other conclusion can be arrived at, in reference to these words, than that they radically imply: 1st, the curved hand; 2nd, anything curved or hollow; 3rd, a cup or container. This, as either *kap*, *kup*, *kaf*, or *cav*, from Iceland to Hawaii.

THE LETTER "V."

Vau, a nail.

This is the name given to the Hebrew letter *V*, whence sprung our *F* and *V* and *Y* (W). In the sense of "nail" it does not seem to have been of wide distribution, and perhaps the uncertainty of its sound, vibrating from *F* and *V* into *P* and *B* made it difficult for the first scribes of language to fix its fluctuations. Under the name of "digamma" it was used in one Greek dialect, and has proved useful in philology in showing how transitions of words have taken place, as, to use the old school-boy example, *Ϝοῖνος* (*i.e.*, *οἶνος*) into Latin *vinum*, wine. It was a fancied resemblance to one *gamma* superimposed on another, Ϝ, which led the grammarians to relinquish the old name of *Ϝαῦ* for this letter. As the name of a nail, it does not seem to have been adopted by the Aryan nations (so far as I can ascertain). Taylor gives the meaning of *vau* as "a peg or nail," but says, "rather, hook, as a hook fastened into the wall for holding clothes." Farrar* gives *vau*, "a tent-peg or hook." The tent-peg would seem the more probable origin among a pastoral and probably a tent-dwelling people, as once the children of Abraham were.

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* See "Cuneiform Inscriptions," Schrader, pp. 199 and 292.

† Massey's remark ("Book of Beginnings," vol. ii., p. 154) that the Egyptian *fa*, "the hand," is a worn-down form of *kefa*, *kaf*, or *kep*, "the hand," is doubtful, if we compare the Maori *wha-wha*, the Tahitian *fa-fa*, "to touch or feel with the hand." The Polynesian is too primitive (apparently) in construction to allow of *kapu* becoming *fa-fa*, and it is probable that these words are from separate roots, but common to both languages. Cuvier and Blumenbach are the authorities that the *ancient* Egyptians were members of the Caucasian race, and that their skulls are purely Asiatic. Baron Bunsen also lends the weight of his great name and learning to this belief. The Icelandic *Fá*, to "touch, grasp, take hold," is also Polynesian.

The Polynesians seem to possess a word of nearly the same sound and signification. Maori *whao*, "a nail, any iron tool, a chisel;" *whaowhao*, "to carve wood;" *kouhao*, "a hole;" *urukowhao*, "leakage in a canoe through the holes made for the lashings of the *rauawa*" (attached sides). Samoan *fao*, "a wooden peg or nail; any kind of gouge used in making the sinnet-holes in canoes; to punch holes in the side of a canoe;" *faofao*, "a long shell, formerly used as a gouge in making the sinnet-holes for lashing together two planks of a canoe." Tahitian *fao*, "a nail or chisel;" "to make holes with a *fao*;" *faoa*, "a stone adze;" *haoa*, "a hard stone, of which adzes were formerly made;" "an adze" made of this stone. Hawaiian *hao*, the name of any hard substance, as iron, the horn of a beast, etc.: strained tightly, hard; *haoapuhi*, (*puhi*, "an eel,") the name of a stick used instead of a hook for catching eels; *ohao*, (for *kohao*,) "to tie," as a rope or string.

The last word brings us to the consideration of the New Zealand Maori words: *whao*, "a nail," and *whau*, "to tie;" *i.e.*, fastening with a peg, and fastening with a cord. *Whau*, with Samoan *fau*, "to tie together," and Tahitian *fafau* (redup.), "to tie together," have sister words throughout Polynesia. I believe that the notion held by one or two Maori linguists, that the word *fau*, used as a verb, "to tie," arose from the noun naming the tree *fau*, (*whau*, or *whauwhi*,) is incorrect, as the word *fau* is applied to different species of trees the bark of which is useful for cordage, or clothing. The *Hibiscus tiliaceus*, the *Broussonetia papyrifera*, a species of *Urtica*, etc., have this word *fau* applied to them in different islands, a fact which points out that *fau* was used as a word meaning "to tie," or "fasten together," before the dispersion of the Maori race in the Pacific.

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* "Language and Languages," p. 117.

TAU, THE LETTER "T."

I now approach by far the most interesting and difficult part of my paper.

The Semitic *tau* was written ×; the Aryan *tau* was written T; both being forms of crossed lines. In writing on the subject of the *tau*, "the headless cross," I shall carefully avoid any (intended) allusion to "the cross" as a Christian symbol. The *tau* form of the cross was in use for untold centuries before the Christian era, and it is to this ancient form of the *tau* that I refer. I do not wish to touch on such perilous ground as the religious side of the question, and am only concerned with the philological and mythological bearings of the letter.

The variations of the letter appear as follows:—The forms, which extend over a vast geographical surface, and over thousands of years of time, differ very slightly. The English capital T is the old Hellenic T (*tau*) and Ethiopian *tawe:* Moabite × *tau*, Nineveh ┌ and ×, Hebrew ×, Thammudite × and +, Sabean ×.

Everywhere in ancient Egyptian painting and sculpture do we find this sacred symbol, "the cross of Taht." It was the emblem of the new life into which Osiris led the souls of those who in life believed on him. In the opinion of many investigators this cross represents "reproduction," and is the emblem of Phallic worship: it is unnecessary, as it would be unprofitable, for me to open up that question here. A single quotation from a work, in which the wonderful industry of the author is not the least astonishing part, will suffice. "The most sacred cross of Egypt, that was carried in the hands of the gods, the Pharaoh, and the mummied dead, was the *ankh* (Pl. XX., fig. 12), 'the sign of life, the living; a covenant, an oath; a pair; to couple and duplicate.'"* How widely this sign of "the cross of the three quarters" was distributed, may be conceived when we consider by what diverse peoples it was adopted and cherished. From the Hebrew (who called his cross *tau*) to the Celt, in Britain of the West, all had adopted the emblem. "It is a fact, not less remarkable than well-attested, that the Druids in their groves were accustomed to select the most stately and beautiful tree as an emblem of the deity they adored, and, having cut off the side branches, they affixed two of the largest of them to the higher part of the trunk, in such a manner that these branches extended on each side like the arms of a man, and, together with the body, presented the appearance of a huge cross, and in the bark in several places inscribed the letter *tau*."†

Since, then, it must be conceded that the Semitic and Aryan *tau* had a wide distribution, we will proceed to endeavour to ascertain if in any case it had the signification of cross or letter in Polynesia.

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* "The Natural Genesis," Massey, vol. i., p. 423.

† "Indian Antiquities," Maurice, vol. vi., p. 49.

The Polynesian word "*tau*" has many and differing significations. I will deal with those which bear upon the subject in hand, leaving the other meanings awhile: feeling confident that if their genesis could be traced they would lead up to one primal fount of original meaning.

"*Tattoo*" is one of two Polynesian words adopted into English: the other word is "*tapu*" (such and such a subject was tabooed). *Tattoo*, in the sense of punctured markings of the skin, is a Tahitian word, derived from the writings of Cook, but not so written by him. He writes it as "*tattow*," thus giving very nearly the sound which in Polynesia we write as *tatau*. *Tatau*, in the sense of tattooing, is not a New Zealand Maori word; the word *ta* is used instead; *ta* = "to tap, strike, to strike the tattooing chisel with a small mallet." It should not be forgotten that there is another meaning in English for "tattoo," viz., a drum-beat (etymology unknown). But the idea of "striking a skin (drum-head) with a stick," is common to both English and Polynesian meanings of "tattoo." The word *tau*, without the duplicate syllable, (in *ta-tau*,) has the following meaning in New Zealand:—*Tau*, "to alight, to rest upon" as a bird; *taupua*, "to rest, to support oneself;" *tautari*, "an upright stick in the walls of a native house, supporting the small battens to which the reeds are fastened;" *tauteka*, "a brace, a prop;" *tauware*, "the thwart of a canoe." Although these words may have some remote connection with the idea of a cross-piece, there is nothing to guide one in any way to such conclusion. But in Hawaiian dialect (where the Maori *t* changes to *k**) we get a glimpse of light. Hawaiian *kau*, "to hang;" "to hang up," "to suspend as an article out of the way;" "to crucify," "to hang up as a criminal;"† *kau*, "to light down upon," as a bird, "to rest upon;" "to stretch over;" *kaulua*, "to put two together," "to yoke together;" *kaulai*, "to hang up." With this idea of resting—viz., to hang upon, to hold up, we return to New Zealand Maori, and find *tautinei*, "to hold up or support a sick person;" *tautoko*, "to prop up or support;" *tautau*, "a string or cluster;" *tauhokai*, "a stake in a river, to which a net is fastened." Most of the words, however, seem to have connection with tying. Let us return to the cross, and see its early form. The primitive *ankh* (cross) was a loop of cords with the ends *crossing* each other, "the *ankh* tie." Wright[*] has a rare English word, *taw*, "to twist or entangle," "to tie." (Obsolete words are invaluable to the student.) In Maori, *tau* means "the string of a garment," "a loop or thong on the handle of a weapon," "a loop forming the handle of a basket;"[†] *tatau*, "to tie;" *tautau*, "to tie in bunches," "a string," "a cluster;" *taukaea*, "thread used for fastening a fish-hook to a line;" *taura*, "a rope or cord," etc. In this sense of tying, we find in other Polynesian dialects: Hawaiian, *kaukau*, "to set or fix a snare for birds;" *kaula*, "a rope;" *kauhilo*, "to fasten with a rope the sticks of a building, while in the course of erection," etc.: Tahitian, *taura*, "a rope, cord, lace, or thread;" *tauete*, "a noose or loop fastened to a mast to fix the sail to:" Samoan, *tau*, "to be anchored;" *tauama*, "the name of a rope in a sailing canoe;" *taufatu*, "to tie on a stone as a weight to a fish-hook;" *taufoe*, "to tie a fishing-line to a paddle," etc. These instances are a few of many hundreds of similar words. But as the Tahitian *tatau* (tattoo) is the Maori *ta*, other meanings of *ta* may be considered. *Ta*, in New Zealand Maori, means "to net," "to make the meshes of a net"—that is to say, to entwine threads by *crossing*, this crossing having the *ankh* tie. The Egyptian *tat* is the cross sign; crossing, tying, and knotting are synonymous. *Ta*, in Egyptian, means "a tie, a knot;" "to tatt."

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* It would perhaps be nearer the truth to say that the sound which we write in New Zealand as *t* is in Hawaiian written *k*.

† As crucifixion is not known to have been a Polynesian punishment, this meaning of *kau* may perhaps be explained by the fact that in Hawaii, the sacrifice, whether man, hog, or fruit, was "hung up" on the tree which was to be used in building a *heiau* (temple). This sacrifice was called *kumakalehua*.

Has all this any bearing on the alphabet in Polynesia? Yes, if this letter *T* was understood in its primitive sense by the Polynesians as a cross. But it meant something more. Did they ever know it as a letter? Somewhat may be inferred from the following evidence: In Maori, *tatau* (which is our Tahitian friend "to tattoo,") means "to count," "to repeat one by one;" but in Hawaii the corresponding word, *kakau*, means "to write," "to make letters," "to write upon," "to print or paint upon *kapa*" (native cloth, *i.e.*, *tapa*), as in former times,[‡]

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[*] "Dictionary of Obsolete and Provincial English."

[†] Compare the German *tau*, "tow," "cable-rope," (Kluge, in his "Etymologisches Worterbuch,") as being connected with our English *tow*, "to drag." But if so, we have the Maori verb *to*, "to drag," "to haul," as a canoe, in a very ancient incantation used on the landing of the Maoris in New Zealand from Hawaiki:—

> "*Toia Tainui ki te moana,*
> *Na wai e to?*"
> "Drag Tainui (canoe) to the ocean!
> Who shall drag her?"

[‡] "The *tapa* is often printed with colours in patterns. This is performed in a mode similar to that used in Europe before the introduction of copper rollers. Instead of engraved blocks, they form tablets (about as thick as binders' boards) of pieces of large cocoanut leaves, by sewing them together. One side of this tablet is kept smooth and even, and upon this cocoanut fibres are sewn so as to form the required pattern, which is, of

"to put down for remembrance," "to describe," "to mark out," "to designate," "a writing;" *kakau-kaha*, "to print, paint, or mark on the skin;" *kau*, "to put down," as words on paper, "to fix the boundaries of a land or country," "to dot," "to give publicity to a thing," "to rehearse in the hearing of another that he may learn;" (*cf.* Maori, *tauira*, "a pattern," "copy," "teacher," "pupil;") *kaukau*, "to take counsel," "to revolve in one's mind." Tahitian, *tatau*,[*] "to count," "to number;" *ihotatau*, "reckoning up of descent," "genealogy." Samoan, *tau*, "to count," "that which is right and proper;" *tau'ese*, "to count wrongly;" *taufau*, "to teach a pigeon." Marquesan, *tatau*, "to reckon," "count." The general idea to be gathered from them all is to mark or dot (tattoo) for counting, or for making signs or emblems by which one thing could be known from another. That the word should stand for "teaching; learning; fixing boundaries; giving publicity," etc., awakens serious thought.[†]

"Nature," reporting a meeting of the British Association (last but one), says that Mr. Haliburton, when speaking on the subject of the *tau*, affirmed that the natives of the Queen Charlotte Islands, one of the most isolated groups in the Pacific (near the American coast), used this symbol "on large sheets of copper, to which they assigned a high value, and each of which they called a *tau*." Here, then, we have evidence of it as *writing*, and as a medium of exchange. But the most conclusive evidence of the value of *tau* as in counting, in its meaning "ten," and its exchange use, is in the consideration of a totally different word, the explanation coming from far-off Madagascar. The Malagasy contains many Malay and some Polynesian words. among them the equivalent for the Maori *hoko*, "to barter."

Hoko, in Maori, has two distinct meanings. one is "to barter," now used in modern speech as "to buy or to sell;" the other meaning, when *hoko* is used as a prefix to numerals, signifying ten times the subjoined numeral. *Toru* = three,

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course, raised upon the surface of the tablet. These tablets are wet with a piece of cloth well soaked in the dye, after which the *tapa*, which for this purpose is well bleached and beautifully white, is laid down upon them and pressed into close contact. The dye is made from herbs, etc, of various colours."—Wilkes' "U.S. Exploring Expedition," p 112.

Compare English *taw-maker*, the "person who, in weaving, works flowers into his work."—Wright's "Dict. Obs. and Prov. Words"

[*] When the Roman officers numbered their soldiers after an engagement they wrote a *tau*, T, against the names of the living.

[†] *Tekau*, the Maori word for "ten," if equivalent to the cross sign, shows a form of crossing by the clasping of the ten fingers, or two arms. Thus, the Roman X, the *decem* ("ten"), is only the Asiatic form of *tau*, and it *may* be found that *tekau* (worn down) was the "tek" of δεκα, *deg*, *teg*, etc., as "ten."

hokotoru = thirty; *whitu* = seven, *hokowhitu* = seventy, etc. If we look in Malagasy for this word, we shall find that *h* is represented by *v*, as Maori *hoe*, "to paddle, to row" = Malagasy *voy*, "the act of rowing;" Maori *hua*, "fruit" = Malagasy *voa*, etc. Looking, then, for the Malagasy equivalent of Maori *hoko*, "to barter," we find *vokovoko*, "a cross, the figure of an ×." This, then, was the medium of buying and selling, the *tau*: and the Maori prefix *hoko*, "raising the number ten times," was used because the *hoko* or *voko* currency was marked with a *tau*, "×," or ten. With this meaning of sale, ten, and ×, must be compared the Tongan *faka-tau*, "to barter, buy, or sell" (*whaka* or *faka* = causative prefix). The word *tau*, in its meaning of "a year," may be explained in connection with "ten" as in Tagal, Mangarevan, and other Pacific dialects, in which *tau* means a year divided into ten months.

Was this sign, this means of communication, merely the net-crossing, the cord-crossing, or the real *tat* cross? It would appear that the *tau* was used in Polynesia, certainly in religious ceremonial and connection. The New Zealand word *tauira*, given in Williams's "Dictionary" as "counterpart," (and so "teacher, pattern, pupil, copy,") means in Maori mythology much more than this. Constantly in the ancient invocations and poetry we find the *tauira* alluded to as some sacred being or beings. In Dr. Shortland's "Maori Religion and Mythology," he translates *Tauira* as "a person who is being instructed by a priest, or by the spirit of a parent or ancestor" (p. 108); but in his translation of the "*Piki ake Tawhaki*" poem, (p. 24) he leaves the *tauira* to signify one of the (untranslatable) heavenly personages to whom Tawhaki was ascending: "to your *Ariki*, to your *Tapairu*, to your *Pukenga*, to your *Whananga*, to your *Tauira*." Also, *tau-tohito* means "an adept," and *taumaha* "a thank-offering" (White). It is to the other Polynesian islands, where far more elaborate systems of ceremonial and worship were observed than among the simple New Zealanders, that we must look for the religious signification of *tau*. In Hawaiian *kau* (*tau*), "to light down upon," as a bird; "to light down upon," *as the Spirit or Divine influence upon one* (Lorrin Andrews). Hence, probably: *kaula*, "a prophet," one who predicts future events; *kaukau*, "a heap of stones made into a rude altar;" *kauila* (see Maori *tauira*, quoted above), "to offer sacrifice at the close of a *kapu* (*tapu*);" *kaumaha* (see Maori, above), "to offer in sacrifice, to kill a victim in sacrifice, to offer a victim on the altar." Samoan *taula*, "the priest of an *aitu* (deity);" *taulaga*, "a sacred offering;" *tauto*, "an oath, to take an oath." Tongan *tautau*, "an offering to the god of the weather." Marquesan (dialect drops *r*) *taua* (for *taura*), "a priest." But most important of all is Tahitian, where *tauhā* (*ha* = four) means "the four stars called the Crosier (Southern Cross);" and *taumaha*, (in Maori, a "thank-offering,") not only "a portion of food offered to the gods or spirits of the dead," (the Latin "*manes*,") but also these "stars of the Southern Cross." In the Maori constellations, the "Pointers" of the Southern Cross* are called the *taura*, generally supposed to mean "cable" (from *taura*, a rope), as the cable of the stellar figure called "the canoe of Tamarereti;" but as *taula* means "an anchor" in Tongan, and *katau* "an anchor" in Marquesan, it is probable that the Southern Cross is the *tau*, the *tau-hā* (four-cross), or *taura*.† It may well be that Massey has solved the problem of the connection between *tatau* "to mark," (tattoo,) and its connection with the cross in the passages treating of the rite of "young-man-making." The pubescent one had crossed and become established in his manhood; hence he was tattooed with the cross, as the sign of foundation. This is the Egyptian *tat* (the cross, or *phallus*), and *tattu* is the region of establishing for ever, in the eschatalogical phase: the place where the *tat* cross was erected when the child Horus had crossed and been united with his masculine force or virile soul, and the two had become one in *tattu* (eternal).‡

The point may well be raised: What was the character of the "*tatau*" among Polynesians formerly? Tattooing seems to have been general, in greater or less degree: the Hawaiians and New Zealanders being the two great sections of the family with whom the face was tattooed as well as parts of the body. In New Zealand, the curves of the modern tattooing ("the tattooing of *Mataora*") are said by Mr. White (whose knowledge of the ancient Maori is very great), to have superseded a different fashion for marking called "the *mokokuri*"—from the description given to Mr. White by the old priests I drew the picture forming the frontispiece of his new work "The Ancient History of the Maori." It can be seen by this (see Plate XX.) that a peculiar system of marking existed: horizontal and vertical lines arranged in sets of threes. This certainly seems to be more like some kind of writing than the decorative flowing curves of modern "*moko*." Let us consider the next figure, that of another Polynesian, a Bowditch Islander, drawn from a sketch in Wilkes' U.S. Exploring Expedition record. Here the lines are replaced by arrowheads; and, although I do not pretend to discern any analogy between these marks and the arrow-headed (or the cuneiform) writing of the Asiatics, I may remind my readers that in Scandinavia, in the Runic system of writing, the letter answering to the Greek *tau* was called *tyr*, and written as an arrow-head,

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* α and β Centauri.

† The feast of the cross was solemnized by the ancient Persians (according to Dupuis) a few days after the entrance (crossing) into the Zodiacal sign of *Aries*, at which time the Southern Cross was visible at night. See "Nat. Gen.," vol. ii., p. 387.

‡ See "Book of Beginnings," p. 437.

(our "broad arrow"). This may be mere coincidence: on the other hand it may be a real link connecting *tau*, T, the cross-letter, with the Polynesian *ta-tau*, "to write, paint, puncture, dot, count, describe, and worship," especially as the Scandinavian *tyr* or *tir* was worshipped as a divinity.[*] To those who would remind me that printing is modern, I would say that the first writing of Asia was the printed (stamped) arrow-head of the cuneiform script, on clay cylinders.

In Maori, the word used for "cross" is *ripeka;* its meanings, "lying across one another," "to lay across," "to mark with a cross," "to crucify." The root is (apparently) *peka*, "a branch," "to branch," (a branch, whether of a tree or of a river,) "to turn aside;" *pekanga*, "a branch road." As the Egyptian *pekh*, "to divide," *pekkha*, "division," and *peka*, "a gap," seem to coincide with this, we may also consider if the Teutonic *beck*, "a stream," has not the same derivation as Maori *peka*, "a branch stream." Close to English and England is the Breton *pech*, "a division." Skeat (our greatest authority on English etymology) says of this word *beck:* "Root unknown." Again the Hawaiian comes forward with a well-preserved ancient meaning: *Pea* (the Hawaiians lose *k* = *peka*,) means "to make a cross," "to set up timbers in the form of a cross," "a cross, or timbers put crosswise," thus: ×, formerly placed before the temples as a sign of *kapu* (taboo). Mr. Andrews ("Haw. Dict.") then gives this most valuable example of the use of the word: "*e kau pea*, 'to place in the form of a cross.'" In this sentence (*e tau peka*), *tau*, used as a verb, is placed with *peka;* and I think the × (the Asiatic *tau*), *placed in front of the temples as a sign of taboo*, quite conclusive as to the sign being considered a sacred one.

A gentleman whose name carries weight as an expert in the Melanesian languages, the Rev. Lorimer Fison, informed me that he considered *kau* was the radical part of the Maori word *rakau*, "a tree," "timber"—wood generally—its compounds in Fijian, etc., leading him to this conclusion. A close study of the Polynesian dialects convinces me of its possibility, the interchange of *k* and *t* being much more common than is generally supposed; not only between Hawaiian and the other dialects, this being regular and seldom departed from; nor as in Samoan, where it is a modern innovation, but even within the New Zealand Maori language itself: *makuru* and *maturuturu*, *whakiwhaki* and *whatiwhati*, etc. Thus, it is possible that *tau* "to float, to rest," may be connected with *kau* "to swim." If that be the case, and that *kau* may mean wood, it would explain many Maori compounds of *kau*, such as *kaunoti*, *kaurimarima*, *kauahi*, etc., terms for sticks used in producing fire by friction. The Egyptian for wood is *khau*. But if *kau* corresponds to *tau*, then this cross set up, to which such sacredness was ascribed, is the child of the old Tree-worship, wherein our own Teutonic ancestors, as well as the men of eastern lands, delighted. The Maori *Tiki*, the carved and sacred post, was thus a deity of the Tree. A Mangaian myth concerning the great *Maui* and his brothers relates: "At the earnest solicitation of *Maui* they consented to follow him. Accordingly he went to the old post of their dwelling, and said as before—

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[*] I do not know if *tir*, the "arrow-head" letter of Scandinavia, is connected with the Persian *tir*, "an arrow;" but, if so, it is probably represented among the Maoris (who do not know the bow and arrow) by *tiri*, "to throw one after the other," "to throw one by one."

"O pillar! open! open up!
That we may all enter and descend to the nether world."

At these words the wonderful pillar at once opened, and all four descended. Maui showed them all the wonders of the spirit-world," etc.* The spirit-world was Avaiki, the New Zealand Hawaiki. It was through the pillar, the sacred Tree, the *Kau* or *Tau*, that entry to that wonderful unknown land of the shadows could be made with safety. I do not know if there is any connection between the Maori *tahu*, "to kindle" (passive *tahuna*) and *tau*, but the sister word to *tahuna* (passive form of *tahu*, "let it be kindled,") is the Hawaiian *kahuna*, "a priest or person who offers sacrifices."† To whom were the sacrifices offered? Probably in ancient times this "kindling" of the sacred fire was in honour of th Sun, the Lord of Fire, the god whose power was first recognised by men, and who has been worshipped at some time in every place.

Whatever *kau* may mean outside Polynesia proper, it is certain that *rakau* is, with slight variations, the true Polynesian word—Samoan *la'au*, Hawaiian *laau*, Tongan *akau*, Tahitian *ruau*, etc. The compound there is *kau* and *ra*, and *Ra* is the Polynesian word for the Sun, as it is the Egyptian, and the ancient Celtic. *La* means "a day" in Gaelic, Irish, Egyptian, and Maori. "La, the Druidical name of God, obsolete in Gaelic but retained in the best Gaelic dictionaries."‡ In Sanscrit, *ra* means "fire, heat, warmth" (Monier Williams). When men—the dwellers in caves, the savage hunters of savage beasts—had through the great discovery of fire-kindling made their first step towards civilization, learnt to cook food, to clear forests, to make canoes, surely their first dawn of worship would be veneration for this spirit of the Sun-fire *Ra* dwelling in the wood, whence it could be evoked by friction. Almost all the great deities of the ancient world were but solar impersonations. Osiris, Horus, Baal, Samas, Thammuz, Hercules, Phaethon,

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* "Myths and Songs of the South Pacific," Gill, p. 70.

† *Tahu*, in Tahiti the name generally employed for "sorcery."

‡ "Gaelic Etymology," Mackay.

Mithra, Agni,—all were Sun, heat, warmth, fire. Taht was a lunar deity. by him men first began to count and reckon time (as in the Polynesian *tatau*, "to count, to write"), for the counting time by moons is the first natural division. Of Taht it is said: "Ra created him a beautiful light to show the name of his evil enemy. . . . Thou art my abode, the god of my abode; behold thou shalt be called Taht, the Abode of Ra."[*] And every meaning of the Polynesian *ra* or *la* finds common meaning in the Aryan languages. Thus *ra* or *la* means not only "sun," but "a sail:" in Danish *raa* means "the yard of the sail;" and in Scottish, *ra* means "the sail-yard." The name of the great Maori kite in the shape of a hawk (presented by Sir George Grey to the Wellington Museum) is Ra. In Egypt the sun was represented with a hawk's head:

> "Oh! thou great god in the east of heaven![†]
> Thou proceedest to the bark of the sun as a divine hawk of time."[‡]

This sun-god was not only worshipped, but worshipped in a peculiar manner: everywhere with sacred (*i.e.*, new-kindled) fire. Among the Latins we come across the passage concerning the "new fire made in the secret temple."[§] So in India, Agni (fire) is called "the child of Dyu (the sky), the son of strength (*i.e.*, produced by the strong rubbing of wood), the light of the sacrifice."[||] "They worshipped Agni with logs of wood, with praise."[¶] In the Zend Avesta, the sacred book of the ancient Persians: "Oh Spenta Armaiti, this man do I deliver unto thee: this man deliver back to me against the day of resurrection; deliver him back as one who knows his Gathas, who knows the Yasna and the revealed law; a wise and clever man, who is the Word incarnate. Then shalt thou call his name Fire-creature, Fire-seed, Fire-offspring, Fire-land, or any name wherein there is fire."[**] Men approached the tree, the bearer of the "fire-seed," with awe and devotion; the tree itself they worshipped as a god and as the gift of a god. Surely the imagination of man never conceived a more mysteriously awful and majestic figure than that of the Scandinavian Odin hanging on the Life Tree. In the words of the Rev. Sir G. Cox,[††] we read: "The Kosmos so called into existence is called the 'Bearer of God'—a phrase which finds its explanation in the World Tree

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[*] "Records of the Past," vol. vi., p. 111.

[†] Compare the Maori *ra-whiti*, the east.

[‡] "Book of the Dead," Birch, cxxxi.

[§] "Adde quod arcanâ fieri novus ignis in æde
Dicitur, et vires flamma refecta capit."—Ovid, in Fasti.

[||] "Rig Veda Sanhita," mandala i., sûkta 165: Max Müller.

[¶] *Idem.*

[**] "Vendidad," fargard xviii.: M.M.

[††] "Mythology of the Aryan Nations," p. 371.

Yggdrasil, on which Odin himself hangs, like the Helene Dendrites of the Cretan legend—

> "I know that I hung, on a wind-swept tree
> Nine whole nights, with a spear wounded,
> And to Odin offered myself to myself,
> On that tree of which no one knows
> From what root it springs."*

It may be urged that I have before stated my conviction that *kau* and *taura* were both cattle-words. My opinion is unchanged (nay, rather strengthened); but the consideration of this subject would cause this paper to be of objectionable length, and it must be left for the present. I will only notice two points briefly. Taylor, in "The Alphabet," when speaking of the Hebrew letters, says: "*Tau*, the last of the letters, is the 'sign' or 'cross' used for marking the ownership of beasts (see Ezekiel ix. 4). The early form of the letter is + or ×, which would be the easiest and most natural mark for such a purpose." It has been stated that from consideration of some other Aryan forms the Latin *taurus*, a bull, and *taura*, a cow, are words which have lost a prefixed *s*, the corresponding word in English (from Teutonic sources) being *steer:* this is made doubtful, perhaps, by Greek *ταῦρος*, ancient Slavonic *touru*, Russian *turu*, Irish *tor*. But if we allow that formerly *ταῦρος* possessed a prefixed sigma, we get *σταυρός*, a cross!

The cross of life and the tree of life were transferable images. The Buddhist cross was a tree of life, which brought forth flowers and leaves, as did the worshipped *Asherah*, "tree," (the "grove") of the Assyrians. When they were, whether in Europe or in Asia, approaching the shrine to offer the "new-made fire," it was with the sacred fire-cross that they drew forth the offering of flame—with the holy Swastika cross. If the *tau* everywhere (as × and T) represented the cross, then reverence and deification of this form of the tree or wood would be speedily granted by the minds of simple men; and the place whereon it stood become holy, as its presence made sacred the temples in the island of Hawaii.

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* "Odin's Rune Song," Thorpe's trans. of "Sæmunds Edda," p. 340.

ART. XLVI.—*Polynesian Folk-lore.—Part II.: The Origin of Fire.*

By E. TREGEAR, F.R.G.S.

[*Read before the Wellington Philosophical Society, 19th October,* 1887.]

IN my first paper on the subject of Polynesian Folk-lore,* I compared the stories treating of the adventures of Hina, the sister of Maui. I will now attempt to compile the different versions of the legend relating the procuring by Maui of fire for the use of man. This tradition is related everywhere in the Polynesian islands with wonderful faithfulness—wonderful when we consider how many centuries must have elapsed since the dispersion of the Maori tribes in the Pacific. I believe that a vast extent of time lies between the parting of New Zealander and Samoan, of Tahitian and Hawaiian; but if the opinions of some scholars (Hale, the American philologist, notably) should be verified concerning the comparatively late departure of the New Zealanders from some South Sea island, still the lapse of years necessary to account for the widely differing customs (kingship, idols, tattooing, tapu, etc.) and the divergence of dialect, must be very great. The more I become conversant with the Polynesian languages, the more thoroughly I feel assured of very ancient branchings in the meaning of expressions common to all; and that it is only those investigators who are satisfied with comparing the most common and vital words (such as those for fire, water, etc.) who can consider the dispersion or migration as recent.

However that may be, we have in the story of the Polynesian Maui, in his character of Prometheus, a tradition more clear and faithful than any which treat of his labours as Hercules—the solar mythologists claim Maui, with I do not know how much reason. Maui is pre-eminently the Hero of Polynesia: sometimes Maui the cunning, the evil; sometimes the kind (*atamai*) and the benefactor. In the "origin of fire" story he is the benefactor. The legends I have gathered together are those which have been told in New Zealand, Samoa, Manihiki, Mangaia, and Nukuhiva (Marquesas). In commencing the New Zealand story I must preface the actual tradition with a short extract from a prior part of the Maui legends; this extract relating to the power Maui possessed of turning himself into a bird at pleasure.† This is necessary, because the bird-dress of Maui plays an important part in the legends of obtaining fire, as told in the South seas. I will quote Sir George Grey's version as the classical one:—

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* "Trans. N.Z. Inst.," vol. xix., p. 486.

† See "Trans. N.Z. Inst.," vol. xix., p. 502.

"His brothers felt quite surprised and pleased with their little brother when they heard him talk in this way; and when after a little time they had recovered from their amazement, they told him to try and find their father and mother. So he said he would go. It was a long time ago that he had finished his first labour, for when he first appeared to his relatives in their house of singing and dancing, he had on that occasion transformed himself into the likeness of all manner of birds, of every bird in the world, and yet no single form that he then assumed had pleased his brothers: but now when he showed himself to them, transformed into the semblance of a pigeon, his brothers said: 'Ah, now indeed, oh brother, you do look very well indeed, very beautiful, very beautiful, much more beautiful than you looked in any of the other forms which you assumed, and then changed from, when you first discovered yourself to us.' What made him now look so well in the shape he assumed was the belt of his mother, and her apron, which he had stolen from her while she was asleep in the house: for the very thing which looked so white upon the breast of the pigeon was his mother's broad belt, and he also had on her little apron of burnished hair from the tail of a dog; and the fastening of her belt was what formed the beautiful black feathers on his throat. He had once changed himself into this form a long time ago, and now that he was going to look for his father and mother, and had quitted his brother to transform himself into the likeness of a pigeon, he assumed exactly the same form as on the previous occasion; and when his brothers saw him thus again, they said, 'Oh brother! oh brother! you do look really well indeed;' and when he sat upon the bough of a tree, oh dear! he never moved or jumped about from spray to spray, but sat quite still, cooing to himself, so that no one who had seen him could have helped thinking of the proverb, 'A stupid pigeon sits on one bough, and jumps not from spray to spray.' Early the next morning, he said to his brothers, as was first stated, 'Now do you remain here, and you will hear something of me after I am gone; it is my great love for my parents that leads me to search for them: now listen to me, and then say whether or not my recent feats were not remarkable. For the fact of transforming oneself into birds can only be accomplished by a man who is skilled in magic, and yet here I, the youngest of you all, have assumed the form of all birds; and now, perhaps, after all, I shall quite lose my art, and become old and weakened in the long journey to the place where I am going.' His brothers answered him thus: 'That might be, indeed, if you were going on a warlike expedition, but, in truth, you are only going to look for those parents who we all so long to see; and if they are found by you, we shall ever after all dwell happily, our present sorrow will be ended, and we shall continually pass backwards and forwards between our dwelling-place and theirs, paying them happy visits.'

"He answered them, 'It is certainly a very good cause which leads me to undertake this journey, and if, when reaching the place I am going to, I find everything agreeable and nice, then I shall perhaps be pleased with it; but if I find it a bad disagreeable place, I shall be disgusted with it.' They replied to him, 'What you say is exceedingly true, depart then upon your journey, with your great knowledge and skill in magic.' Then their brother went into the wood, and came back to them again, looking just as if he were a real pigeon. His brothers were quite delighted, and they had no power left to do anything but admire him.

"Then off he flew, until he came to the cave which his mother had run down into, and he lifted up the tuft of rushes. Then down he went, and disappeared in the cave, and shut up its mouth again so as to hide the entrance. Away he flew very fast indeed, and twice he dipped his wing, because the cave was so narrow. Soon he reached nearly to the bottom of the cave, and flew along it; and again, because the cave was so narrow, he dips first one wing and then the other, but the cave now widened, and he dashed straight on.

"At last he saw a party of people coming along under a grove of trees; they were *manapau* trees,* and flying on, he perched upon the top of one of these trees, under which the people had seated themselves; and when he saw his mother lying down upon the grass by the side of her husband, he guessed at once who they were, and he thought, 'Ah, there sit my father and mother right under me,' and he soon heard their names as they were called to by their friends, who were sitting with them. Then the pigeon hopped down, and perched on another spray a little lower, and it pecked off one of the berries off the tree and dropped it gently down, and hit the father with it gently on the forehead; and some of the party said, 'Was it a bird that threw that down?' but the father said, 'Oh no, it was only a berry that fell by chance.' Then the pigeon again pecked off some of the berries from the tree, and threw them down with all its force, and struck both father and mother so that he really hurt them. Then they cried out, and the whole party jumped up and looked into the tree, and as the pigeon began to coo, they soon found out from the noise where it was sitting among the leaves and branches, and the whole of them, the chiefs and common people alike, caught up stones to pelt the pigeon with, but they threw for a very long time without hitting it. At last the father tried to throw up at it. Ah! he struck it; but Maui had himself contrived that he should be struck by the stone his father threw; for, but by his own choice, no one could have hit him. He was struck exactly upon his left leg, and down he fell, and as he lay fluttering and struggling upon the ground, they all ran to catch him, but lo, the pigeon had turned into a man!

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* "The *manapau* was a species of tree peculiar to the country whence the people came, where the priests say it was known by this name."—GREY. The *manapau* is a tree of Samoa.—TREGEAR.

"Then all those who saw him were frightened at his fierce glaring eyes, which were red, as if painted with red ochre, and they said: 'Oh, it is now no wonder that he so long sat still up in the tree; had he been a bird he would have flown off long before, but he is a man;' and some of them said, 'No, indeed, rather a god—just look at his form and appearance, the like has never been seen before, since Rangi and Papa-tu-a-nuku were torn apart.' Then Taranga said, 'I used to see one who looked like this person every night when I went to visit my children, but what I saw then excelled what I see now: just listen to me. Once as I was wandering upon the sea-shore, I prematurely gave birth to one of my children, and I cut off the long tresses of my hair and bound him up in them, and threw him into the foam of the sea, and after that he was found by his great ancestor Tama-nui-ki-te-Rangi;' and then she told his story nearly in the same words that Maui-the-infant had told it to herself and his brothers in their house, and, having finished his history, Taranga ended her discourse to her husband and his friends.

"Then his mother asked Maui, who was sitting near her, 'Where do you come from? from the westward?' and he answered, 'No.' 'From the north-east, then?' 'No.' 'From the south-east, then?' 'No.' 'From the south, then?' 'No.' 'Was it the wind which blows upon me, which brought you here to me, then?' When she asked this, he opened his mouth and answered, 'Yes.' And she cried out, 'Oh, then, this is indeed my child,' and she said 'Are you Maui-taha?' He answered, 'No.' Then said she, 'Are you Maui-tikitiki-o-Taranga?' and he answered 'Yes.' And she cried aloud, 'This is indeed my child. By the winds and storms and wave-uplifting gales he was fashioned and became a human being: welcome, oh my child, welcome! by you shall hereafter be climbed the threshold of the house of your great ancestor, Hine-nui-te-po, and death shall henceforth have no power over man.'"

I now pass over the parts of the legend treating of the wonderful feats performed by Maui, and take up the thread of the tradition concerning the search for fire.

"The hero now thought that he would extinguish and destroy the fires of his ancestress Mahu-ika. So he got up in the night, and put out the fires left in the cooking-houses of each family in the village: then, quite early in the morning, he called aloud to the servants, 'I hunger, I hunger; quick, cook some food for me.' One of the servants thereupon ran as fast as he could to make up the fire to cook some food, but the fire was out; and as he ran round from house to house in the village to get a light, he found every fire quite out—he could nowhere get a light. When Maui's mother heard this, she called out to the servants and said, 'Some of you repair to my great ancestress Mahu-ika: tell her that fire has been lost upon earth, and ask her to give some to the world again.' But the slaves were alarmed, and refused to obey the commands which their masters, the sacred old people, gave them; and they persisted in refusing to go, notwithstanding the old people repeatedly ordered them to do so.

"At last Maui said to his mother: 'Well, then, I will fetch down fire for the world; but which is the path by which I must go?' And his parents, who knew the country well, said to him: 'If you will go, follow that broad path that lies before you there, and you will reach at last the dwelling of an ancestress of yours; and if she asks you who you are, you had better call out your name to her, then she will know you are a descendant of hers; but be cautious and do not play any tricks with her, because we have heard that your deeds are greater than the deeds of men, and that you are fond of deceiving and injuring others, and perhaps you even now intend in many ways to deceive this old ancestress of yours; but pray be cautious not to do so.'

"But Maui said: 'No; I only want to bring fire away for men, that is all, and I will return again as soon as I can do that.' Then he went, and reached the abode of the goddess of fire; and he was so filled with wonder at what he saw, that for a long time he could say nothing. At last he said: 'Oh, lady! would you rise up? Where is your fire kept? I have come to beg some from you.' Then the old lady rose right up, and said: 'Au-e! who can this mortal be?' And he answered, 'It's I.' 'Where do you come from?' said she; and he answered, 'I belong to this country.' 'You are not from this country,' said she, 'your appearance is not like that of the inhabitants of this country. Do you come from the north-east?' He replied, 'No.' 'Do you come from the south-east?' He replied, 'No.' 'Are you from the south?' He replied, 'No.' 'Are you from the westward?' He answered, 'No.' 'Come you then from the direction of the wind, which blows right upon me?' and he said: 'I do.' 'Oh, then,' cried she, 'you are my grandchild! What do you want here?' He answered, 'I am come to beg fire from you.' She replied: 'Welcome, welcome! here, then, is fire for you.'

"Then the aged woman pulled out her nail; and, as she pulled it out, fire flowed from it, and she gave it to him. And when Maui saw she had drawn out her nail to produce fire for him, he thought it a most wonderful thing! Then he went a short distance off, and, when not very far from her, he put the fire out, quite out; and returning to her again, said: 'The light you gave me has gone out; give me another.' Then she caught hold of another nail, and pulled it out as a light for him; and he left her, and went a little on one side, and put that light out also; then he went back to her again, and said: 'Oh, lady, give me, I pray you, another light, for the last one has also gone out.' And thus he went on and on, until she had pulled out all the nails of the fingers of one of her hands; and then she began with the other hand, until she had pulled all the finger-nails out of that hand too; and then she commenced on the nails of her feet, and pulled them also out in the same manner, except the nail of one of her big toes. Then the aged woman said to herself at last: 'This fellow is surely playing tricks with me.'

"Then out she pulled the one toe-nail that she had left, and it, too, became fire, and as she dashed it down on the ground the whole place caught fire. And she cried out to Maui, 'There, you have it all now!' And Maui ran off, and made a rush to escape; but the fire followed hard after him, close behind him, so he changed himself into a fleet-winged eagle, and flew with rapid flight; but the fire pursued, and almost caught him as he flew. Then the eagle dashed down into a pool of water; but when he got into the water he found that almost boiling. The forests just then also caught fire, so that he could not alight anywhere; and the earth and the sea both caught fire too, and Maui was very near perishing in the flames.

"Then he called on his ancestors, Tawhiri-matea and Whatiri-matakataka, to send down an abundant supply of water; and he cried aloud, 'Oh! let water be given to me to quench this fire which pursues after me;' and, lo! then appeared squalls and gales, and Tawhiri-matea sent heavy, lasting rain, and the fire was quenched; and before Mahuika could reach her place of shelter she almost perished in the rain, and her shrieks and screams became as loud as those of Maui had been when he was scorched by the pursuing fire: thus Maui ended this proceeding. In this manner was extinguished the fire of Mahuika, the goddess of fire; but before it was all lost she saved a few sparks which she threw, to protect them, into the *kaikomako* and a few other trees, where they are still cherished; hence men yet use portions of the wood of these trees for fire when they require a light."

Many versions of this story are related in New Zealand; but they differ little, and in no essential particular. Taylor gives a brief account of the legend,* and enumerates the trees which contain the "seed of fire"—these are the patete, kaikomako, mahoe, totara, and pukatea; the trees which refused to admit the seeds of fire were the rata, hinau, kahikatea, rimu, matai, and miro. The late Rev. Mr. Wohlers, a missionary long resident in the South Island, relates the story as preserved among the southern natives, and told in the Murihiku dialect;[*] there is little variation except in the concluding portion. Mr. John White gives many versions of the story in the second volume of his "Ancient Maori History;" but they are all coincident with the tales told by Sir George Grey and Mr. Wohlers; the only important point which is new being that (at page 71): "Te-raka was the father and Mahuika the mother of Maui. The *kahu* (*Circus gouldi*) was also her child, and was the god of fire. The feathers of the *kahu* resemble fire, whence their red colour originated." Here we have a direct reference to the hawk-god (*Ra*) of ancient history, and a point is lost when Grey and Wohlers (for poetry-sake, doubtless) translate *kahu* as "eagle." The eagle is unknown in New Zealand, and the hawk is mythologically the right bird. These legends of Grey, White, and Wohlers are the principal forms of the New Zealand tale; but there is another version sometimes to be heard among the Natives in which Mahuika is represented as a male deity. I so heard the story many years ago, but cannot give authority.

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* "Te Ika a Maui," Rev. Richard Taylor, ed. 1870, p. 130.

We will now pass to the Samoan story.[†] "The Samoans say that there was a time when their ancestors ate everything raw, and that they owe the luxury of cooked food to one Ti'iti'i, the son of a person called Talaga. This Talaga was high in favour with the earthquake god, Mafuie, who lived in a subterranean region where there was fire continually burning. On going to a certain perpendicular rock, and saying, 'Rock, divide, I am Talaga: I have come to work!' the rock opened and let Talaga in; and he went below to his plantation in the land of this god Mafuie. One day Ti'iti'i. the son of Talaga, followed his father, and watched when he entered. The youth, after a time, went up to the rock, and feigning his father's voice, said, 'Rock, divide! I am Talaga; I have come to work!' and was admitted too. His father, who was at work in his plantation, was surprised to see his son there, and begged him not to talk loud, lest the god Mafuie should hear him, and be angry. Seeing smoke rising, he inquired of his father what it was. His father said it was the fire of Mafuie. 'I must go and get some,' said the son. 'No,' said the father, 'he will be angry. Don't you know that he eats people?' 'What do I care for him?' said the daring youth; and off he went, humming a song, towards the smoking furnace. 'Who are you?' said Mafuie. 'I am Ti'iti'i, the son of Talaga. I am come for some fire.' 'Take it,' said Mafuie. He went back to his father with some cinders, and the two set to work to bake some *taro*. They kindled a fire, and were preparing the *taro* to put on the hot stones, when suddenly the god Mafuie blew up the oven, scattered the stones about, and put out the fire. 'Now,' said Talaga, 'did I not tell you Mafuie would be angry?' Ti'iti'i went off in a rage to Mafuie, and without any ceremony commenced with, 'Why have you broken up our oven and put out our fire?' Mafuie was indignant at such a tone and language, rushed at him, and there they wrestled with each other. Ti'iti'i got hold of the right arm of Mafuie, grasped it with both hands, and gave it such a wrench that it broke off. He then seized the other arm, and was going to twist it off next, when Mafuie declared himself beaten, and implored Ti'iti'i to have mercy, and spare his left arm. 'Do let me have this arm,' said he; 'I need it to hold Samoa straight and level. Give it to me, and I will let you have my hundred wives.' 'No, not for that,' said Ti'iti'i. 'Well, then, will you take fire? If you let me have my left arm you shall have fire, and you may ever after this eat cooked food.' 'Agreed,' said Ti'iti'i; 'you keep your arm, and I have fire.' 'Go,' said Mafuie; 'you will find the fire in every wood you cut.' And hence, the story adds, Samoa, ever since the days of Ti'iti'i, has eaten cooked food from the fire which is got from the friction of rubbing one piece of dry wood against another. . . . The Natives of Savage Island, 300 miles to the south of Samoa, have a somewhat similar tale about the origin of fire. Instead of Talaga and Ti'iti'i, they give the names of Maui the father, and Maui the son. Instead of going through a rock, their entrance was down through a reed bush. And instead of a *stipulation* for the fire, they say that the youth Maui, like another Prometheus, *stole* it, ran up the passage, and, before his father could catch him, he had set the bush in flames in all directions. The father tried to put it out, but in vain; and they further add, that ever since the exploit of young Maui, they have had fire and cooked food in Savage Island."*

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[*] "Trans. N.Z. Inst.," vol. vii., pp. 7 and 88.

[†] The ' of Samoa is a soft catch of the breath, denoting a lost *k*; thus *Ti'iti'i* is the the New Zealand *Tikitiki*. The *g* is *ng* of Maori.

The Bowditch Islanders (Tokelau Islands) also knew the legend, and called the fire-goddess Mafuike; but she was blind, a fact coincident with other versions related further on.

In the Hervey Islands the legend is (at Mangaia) as follows:—

"Originally fire was unknown to the inhabitants of this world, who of necessity ate raw food. In the nether world

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* "Samoa, a Hundred Years ago," G. Turner, LL.D., p. 209.

(Avaiki)* lived four mighty ones: Mauiki, god of fire; the sun-god Rā; Ru, supporter of the heavens; and, lastly, his wife Buataranga, guardian of the road to the invisible world.

"To Ru and Buataranga was born a famous son Māui. At an early age Maui was appointed one of the guardians of this upper world where mortals live. Like the rest of the inhabitants of the world he subsisted on uncooked food. The mother, Buataranga, occasionally visited her son; but always ate her food apart, out of a basket brought with her from nether-land. One day, when she was asleep, Maui peeped into her basket, and discovered cooked food. Upon tasting it, he was decidedly of opinion that it was a great improvement upon the raw diet to which he was accustomed. This food came from nether-world; it was evident that the secret of fire was there. To nether-world, the home of his parents, he would descend to gain this knowledge, so that ever after he might enjoy the luxury of cooked food. On the following day Buataranga was about to return to Avaiki (nether-world) when Maui followed her through the bush without her knowing it. This was no difficult task, as she always came and returned by the same road. Peering through the tall reeds, he saw his mother standing opposite a black rock, which she addressed as follows:—

'Buataranga, descend thou bodily through this chasm.
The rainbow-like must be obeyed.
As two clouds parting at dawn,
Open, open up my road to nether-world, ye fierce ones!'

At these words the rock divided, and Buataranga descended. Maui carefully treasured up those magic words; and without delay started off to see the god Tane, the owner of some wonderful pigeons. He earnestly begged Tane to lend him one; but the proffered pigeon, not pleasing Maui, was at once returned to its owner. A better pigeon was offered to the fastidious borrower, but was rejected. Nothing would content Maui but the possession of Akaotu, (or 'Fearless,') a red pigeon specially prized by Tane. It was so tame that it knew its name, and, wander wherever it might, it was sure to return to its master. Tane, who was loth to part from his pet, extracted a promise from Maui that the pigeon should be restored to him uninjured. Maui now set off in high spirits, carrying with him his red pigeon, to the place where his mother had descended. Upon pronouncing the magic words which he had overheard, to his great delight the rock opened, and Maui entering the pigeon descended. Some assert that Maui transformed himself into a small dragon-fly, and perched upon the back of the pigeon made his descent. The two fierce guardian demons of the chasm, enraged at finding themselves imposed upon by a stranger, made a grab at the pigeon, intending to devour it. Fortunately, however, for the borrower, they only succeeded in getting possession of the tail, whilst the pigeon, *minus* its beautiful tail, pursued its flight to the shades. Maui was grieved at the mishap which had overtaken the pet bird of his friend Tane.

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* The Hervey Islanders drop *h*; hence *Avaiki* = Maori *Hawaiki*.

"Arrived at nether-land, Maui sought for the home of his mother. It was the first house he saw: he was guided to it by the sound of her cloth-flail. The red pigeon alighted on an oven-house, opposite to the open shed where Buataranga was beating out cloth. She stopped her work to gaze at the red pigeon, which she guessed to be a visitor from the upper world, as none of the pigeons in the shades were red. Buataranga said to the bird, 'Are you not come from "daylight?"' The pigeon nodded assent. 'Are you not my son Maui?' inquired the old woman. Again the pigeon nodded. At this, Buataranga entered her dwelling, and the bird flew to a bread-fruit tree. Maui resumed his proper human form, and went to embrace his mother, who inquired how he had descended to nether-world, and the object of his visit. Maui avowed that he had come to learn the secret of fire. Buataranga said, 'This secret rests with the fire-god Mauike. When I wish to cook an oven, I ask your father Ru to beg a lighted stick from Mauike.' Maui inquired where the fire-god lived. His mother pointed out the direction, and said it was called Are-aoa = house of banyan-sticks. She entreated Maui to be careful 'for the fire-god is a terrible fellow, of a very uncertain temper.' Maui now walked up boldly towards the house of the fire-god, guided by the curling column of smoke. Mauike, who happened at the moment to be cooking an oven of food, stopped his work, and demanded what the stranger wanted. Maui replied, 'A fire-brand.' The fire-brand was given. Maui carried it to a stream running past the bread-fruit tree, and there extinguished it. He now returned to Mauike, and obtained a second fire-brand, which he also extinguished in the stream. The third time a lighted stick was demanded of the fire-god; he was beside himself with rage. Raking the ashes of his oven, he gave the daring Maui some of them on a piece of dry wood. These live coals were thrown into the stream, as the former lighted sticks had been.

"Maui correctly thought that a fire-brand would be of little use unless he could obtain the secret of fire. The brand would eventually go out; but how to reproduce the fire? His object, therefore, was to pick a quarrel with the fire-god, and compel him by sheer violence to yield up the invaluable secret, as yet known to none but himself. On the other hand, the fire-god, confident in his own prodigious strength, resolved to destroy this insolent intruder into his secret. Maui, for the fourth time, demanded fire of the enraged fire-god. Mauike ordered him away under pain of being tossed into the air, for Maui was small of stature. But the visitor said he should enjoy nothing better than a trial of strength with the fire-god. Mauike entered his dwelling to put on his war girdle (*ume i tona maro*); but on returning found that Maui had swelled himself to an enormous size. Nothing daunted at this, Mauike boldly seized him with both hands, and hurled him to the height of a cocoanut-tree. Maui contrived in falling to make himself so light that he was in no degree hurt by his adventure. Mauike, maddened that his adversary should yet breathe, exerted his full strength, and next time hurled him far higher than the highest cocoanut-tree that ever grew. Yet Maui was uninjured by his fall; whilst the fire-god lay panting for breath. It was now Maui's turn. Seizing the fire-god, he threw him up to a dizzy height, and caught him like a ball with his hands. Assured that this was but a preparation for a final toss, which would seal his fate, the panting and thoroughly exhausted Mauike entreated Maui to stop and to spare his life. Whatever he desired should be his.

"The fire-god, now in a miserable plight, was allowed to breathe awhile. Maui said: 'Only on one condition will I spare you: tell me the secret of fire. Where is it hidden? How is it produced?' Mauike gladly promised to tell him all he knew, and led him inside his wonderful dwelling. In one corner there was a quantity of fine cocoanut fibre; in another, bundles of fire-yielding sticks, the *au* (lemon, *Hibiscus*), the *oronga* (*Urtica argentea*), the *tauinu*, and particularly the *aoa* (*Ficus indicus*) or banyan tree. These sticks were all dry and ready for use. In the middle of the room were two smaller sticks by themselves. One of these the fire-god gave to Maui, desiring him to hold it firmly, while he himself plied the other most vigorously. And thus runs—

THE FIRE-GOD'S SONG.

'Grant, oh, grant me thy hidden fire,
Thou banyan tree!
Perform an incantation;
Utter a prayer to (the spirit of)
The banyan tree!
Kindle a fire for Mauike,
Of the dust of the banyan tree.'

"By the time this song was completed, Maui, to his great joy, perceived a faint smoke arising out of the fine dust produced by the friction of one stick upon another. As they persevered in their work the smoke increased; and, favoured with the fire-god's breath, a slight flame arose, when the fine cocoanut fibre was called into requisition to catch and increase the flame. Mauike now called to his aid the different bundles of sticks, and speedily got up a blazing fire, to the astonishment of Maui. The grand secret of fire was secured. But the victor resolved to be revenged for his trouble, and his tossing in the air, by setting fire to his fallen adversary's abode. In a short time all nether-world was in flames, which consumed the fire-god and all he possessed. Even the rocks cracked and split with the heat: hence the ancient saying,—

'The rocks at Orovaru (in the shades) are burning.'*

"Ere leaving the land of ghosts, Maui carefully picked up the two fire-sticks, once the property of Mauike, and hastened to the bread-fruit tree, where the red pigeon, 'Fearless,' quietly awaited his return. His first care was to restore the tail of the bird, so as to avoid the anger of Tane. There was no time to be lost, for the flames were rapidly spreading. He re-entered the pigeon, which carried his fire-sticks one in each claw, and flew to the lower entrance of the chasm. Once more pronouncing the words he learnt from Buataranga, the rocks parted, and he got safely back to this upper world. Through the good offices of his mother, the pigeon met with no opposition from the fierce guardians of the road to the shades. On again entering into light, the red pigeon took a long sweep, alighting eventually in a lovely, secluded valley, which was thenceforth named Rupe-tau, or "the pigeon's resting-place." Maui now resumed his original human form, and hastened to carry back the pet bird of Tane.

"Passing through the main valley of Keia, he found that the flames had preceded him, and had found an aperture at Teaoa, since closed up. The Kings Rangi and Mokoiro trembled for their land: for it seemed as if everything would be destroyed by the devouring flames. To save Mangaia from utter destruction, they exerted themselves to the utmost, and finally succeeded in putting out the fire. Rangi thenceforth adopted the new name of *Matamea*, (or "watery-eyes,") to commemorate his sufferings; and Mokoiro was ever after called *Auai* (or "smoke"). The inhabitants of Mangaia availed themselves of the conflagration to get fire, and to cook. But after a time the fire went out, and as *they* were not in possession of the secret they could not get *new* fire. But Maui was never without fire in *his* dwelling: a circumstance that excited the surprise of all. Many were the inquiries as to the cause. At length he took compassion on the inhabitants of the world, and told them the wonderful secret: that fire lies hidden in the *Hibiscus*, the *Urtica argentea*, the *tauinu*, and the banyan. This hidden fire might be elicited by the use of fire-sticks, which he produced. Finally, he desired them to chant the "Fire-god's Song," to give efficacy to the use of the fire-sticks. From that memorable day all the dwellers in this upper world used fire-sticks with success, and enjoyed the luxuries of light and cooked food. . . . At

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* Equivalent to saying: "The foundations of the world are on fire."

Rarotonga, Buataranga becomes *Ataranga* ; at Samoa, *Talaga*. In the Samoan dialect, Manike becomes *Mafuie*."[*]

Manihiki is an island situated about 600 miles north of Rarotonga. They possess the fire-gaining legend, with some difference of detail. It runs as follows :—

"On the Island of Rarotonga once lived Manuahifare and his wife Tongoifare, offspring of the god Tangaroa. Their eldest son was named Maui the First, the next Maui the Second. Then followed their sister Inaika (= *Ina the fish*.)[†] The youngest was a boy, Maui the Third. Like all other young Polynesians, these children delighted in the game of hide-and-seek. One day Inaika hid her pet brother, Maui the Third, under a pile of dry sticks and leaves, and then desired the elder boys to search for him. They sought everywhere in vain. Inaika at last pointed to the pile, and naturally expected to see her little brother emerge from his hiding-place, as the sticks were scattered to the right and left. The heap had disappeared, but no Maui was to be seen. What had become of him? But after a few minutes they were astonished to see him start up from under a few bits of decayed wood and some leaves which had been thoroughly searched a few seconds before. This was the first intimation of Maui the Third's future greatness. This wonderful lad had noticed that his father, Manuahifare, mysteriously disappeared at dawn of every day, and in an equally mysterious way came back again to their dwelling at night. He resolved to discover this secret, which seemed to him the more strange as, being the favourite, he slept by the side of Manuahifare, and yet never knew when or how he disappeared. One night he lay awake until his father unfastened his girdle in order to sleep. Very cautiously did Maui the Younger take up one end, and place it under himself, without attracting his father's notice. Early next morning this precocious son was roused from his slumbers by the girdle being pulled from under him. This was just as he desired; he lay perfectly still to see what would become of Manuahifare. The unsuspecting parent went, as he was wont, to the main pillar of his dwelling, and said,—

'Oh, pillar! open, open up,
That Manuahifare may enter and descend to nether-world' (Avaiki).

The pillar immediately opened, and Manuahifare descended. That same day the four children of Manuahifare went back to their old game of hide-and-seek. This time Maui the Younger told his brothers and sister to go outside the house, whilst he should look for some place to hide in. As soon as they were out of sight, he went up to the post through which his father had disappeared, and pronounced the magic words he had overheard. To his great joy the obedient post opened up, and Maui boldly descended to the nether regions. Manuahifare was greatly surprised to see his son down there, but after saluting (literally, "smelling,") him, quietly proceeded with his work.

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[*] "Myths and Songs from the South Pacific," Rev. W. W. Gill, B.A., p. 51, *et seq.*

[†] See "Hina's Voyage to the Sacred Isle," Tregear, "Trans. N.Z. Inst.," vol. xix., p. 486.

"Maui the Third went on an exploring tour through these unknown subterranean regions, the entrance to which he had luckily discovered. Amongst other wonderful things, he fell in with a blind old woman bending over a fire, where her food was being cooked. In her hand she held a pair of tongs (*i.e.*, a green cocoanut mid-rib, split open). Every now and then she carefully took up a live coal and placed it on one side, supposing it to be food, whilst the real food was left to burn to cinder in the fire! Maui inquired her name, and to his surprise found it was Inaporari, (or *Ina-the-Blind*,) his own grandmother! The clever grandson heartily pitied the condition of the poor old creature, but would not reveal his own name. Close to where he stood watching the futile cooking of Ina-the-Blind grew four *nono* trees (*Morindo citrifolia*). Taking up a stick, he gently struck the nearest of the four trees. Ina-the-Blind angrily said: 'Who is that meddling with the *nono* belonging to Maui the Elder?' The bold visitor to nether-world then walked up to the next tree and tapped it gently. Again the ire of Ina-the-Blind was excited, and she shouted: 'Who is this meddling with the *nono* of Maui the Second?' The audacious boy struck a third tree, and found it belonged to his sister, Inaika. He now exultingly tapped the fourth and last *nono* tree, and heard his old grandmother ask: 'Who is this meddling with the *nono* of Maui the Third?' 'I am Maui the Third,' said the visitor. 'Then,' said she, 'you are my grandson, and this is your tree.'

"Now when Maui first looked at his own *nono*-tree, it was entirely destitute of leaves and fruit: but after Ina-the-Blind had spoken to him, he again looked, and was surprised to see it covered with glossy leaves and fine apples—though not ripe. Maui climbed up into the tree and plucked one of the apples. Biting off a piece of it, he stepped up to his grandmother and threw it into one of her blind eyes. The pain was excruciating, but sight was at once restored to the eye which had so long been blind. Maui plucked another apple, and, biting off a piece of it, threw it into the other eye of his grandmother: and lo! sight again was restored to it also. Ina-the-Blind was delighted to see again, and, in gratitude, said to her grandson, 'All above and all below (= All on earth and all in spirit-land) are subject to thee, and to thee only.' Ina, once called 'the Blind,' now instructed Maui in all things found within her territory: that as there were four species of *nono*, so there are four varieties of cocoanuts and four of *taro* in Avaiki—*i.e.*, one for each child of

Manuahifare. Maui asked Ina, 'Who is lord of fire?' She replied, 'Thy grandfather, *Tangaroa-tui-mata*' (or Tangaroa-of-the-tattooed-face). 'Where is he?' inquired Maui. 'Yonder,' rejoined his grandmother; 'but do not go to him. He is a terribly irritable fellow; you will surely perish.' But as Maui persisted, the grateful goddess Ina said, 'There are two roads to his dwelling. One of these is the *path of death*; whoever unwittingly approaches the Great Tangaroa by this path, dies: the other is the common (or "safe," *noa*) road.' Maui disdained to tread the path of safety. Knowing his own prowess, he boldly trod the path of death. Tangaroa-of-the-tattooed-face, seeing Maui advancing, raised his right *hand* to kill him—that hand which as yet had never failed to destroy its victim. But Maui, nothing daunted, lifted his right hand. At this, Tangaroa, not liking the aspect of Maui, raised his right *foot*, for the purpose of kicking to death the luckless intruder. But Maui was prepared to do the same to the Lord of Fire with *his* right foot. Astounded at this piece of audacity, Tangaroa demanded his name. The visitor replied, 'I am Maui the Younger.' The god now knew it to be his own grandson. 'What did you come for?' 'To get fire,' was the response of Maui. Tangaroa-of-the-tattooed face gave him a lighted stick, and sent him away. Maui walked to a short distance, and finding some water, like that dividing the two islets collectively called Manihiki, extinguished the lighted stick. Three times this process was repeated. The fourth time all the firebrands were gone, and Tangaroa had to fetch two dry sticks to rub together, in order to produce fire. Maui held the under one for his grandfather: but just as the fine dust in the groove was igniting, the impudent Maui blew it all away. Tangaroa, justly irritated at this, drove Maui away, and summoned a *kakaia* (or 'tern,') to come to his assistance, to hold down the lower piece of wood, whilst Tangaroa diligently worked away with the other stick. At last, to the infinite joy of Maui, fire was obtained. It was no longer a mystery. Maui suddenly snatched the upper stick, one end of which was burning, out of the hand of Tangaroa. The patient bird of white plumage still firmly clutched with her claws the under fire-stick, when Maui purposely burnt either side of the eye of the bird. The indignant tern, smarting at this ill-requital, fled away for ever. Hence the black marks, resembling a pair of eyebrows, on either side of the eye of this beautiful bird to this day. Tangaroa reproached his grandson with having thus wantonly deprived him of the valuable services of his favourite bird. Maui deceitfully said, 'Your bird will come back.' Maui next proposed to Tangaroa that they should both fly up to daylight, through the hole by which the bird had escaped. The god inquired how this could be accomplished. Maui at once volunteered to show the way, and actually flew to a considerable height like a bird. Tangaroa-of-the-tattooed-face was greatly delighted. Maui came down to the ground, and urged his grandfather to imitate his example. 'Nothing,' said Maui, 'is easier than to fly.' At his grandson's suggestion, Tangaroa put on his glorious *girdle*, by mortals called the *rainbow*, and, to his immense delight, succeeded in rising above the loftiest cocoanut tree. The crafty Maui took care to fly lower than Tangaroa, and getting hold of one end of the old man's girdle, he gave it a smart pull, which brought down poor Tangaroa from his giddy elevation. The fall killed Great Tangaroa.

"Pleased with his achievement in getting the secret of fire from his grandfather, and then killing him, he returned to his parents, who had both descended to nether-land. Maui told them that he had got the secret of fire, but withheld the important circumstance that he had killed Tangaroa. His parents expressed their joy at his success, and intimated their desire to go and pay their respects to the supreme Tangaroa. Maui objected to their going at once. 'Go,' said he, 'on the *third* day. I wish to go myself to-morrow.' The parents of Maui acquiesced in this arrangement. Accordingly, on the next day, Maui went to the abode of Tangaroa, and found the body entirely decomposed. He carefully collected the bones, put them inside a cocoanut shell, carefully closed the tiny aperture, and finally gave them a thorough shaking. Upon opening the cocoanut shell, he found his grandfather to be alive again. Liberating the divinity from his degrading imprisonment, he carefully washed him, anointed him with sweet-smelling oil, fed him, and then left him to recover strength in his own dwelling. Maui now returned to his parents, Manuahifare and Tongoifare, and found them very urgent to see Tangaroa. Again, Maui said, 'Wait till to-morrow.' The fact was, he greatly feared their displeasure, and had secretly resolved to make his way back to the upper world he had formerly inhabited, whilst his parents were on their visit to Tangaroa. Upon visiting the god on the morning of the *third* day, Manuahifare and Tongoifare were greatly shocked to find that he had entirely lost his old proud bearing, and that on his face were the marks of severe treatment. Manuahifare asked his father Tangaroa the cause of this. 'Oh,' said the god, 'your terrible boy has been here ill-treating me. He killed me; then collected my bones and rattled them about in an empty cocoanut shell; he then finally made me live again, scarred and enfeebled, as you see. Alas! that fierce son of yours.' The parents of Maui wept at this, and forthwith came back to the old place in Avaiki in quest of their son, intending to scold him well. But he had made his escape to the upper world, where he found his two brothers and his sister Inaika in mourning for him, whom they never expected to see again. Maui the Third told them that he had made a grand discovery—he had obtained the secret of fire. He had found a new land. 'Where is it situated?' inquired they. 'Down *there*,' said Maui the Younger. 'Down *where?*' they demanded. 'Down there,' again shouted Maui. The fact was, they were not aware of the secret opening in their house leading to Avaiki. At the earnest solicitation of Maui, they all consented to follow him. Accordingly, he went to the old post of their dwelling, and said as before :—

> 'O pillar! open, open up,
> That we may all enter, and descend to nether world.'

At these words the wonderful pillar at once opened, and all four descended. Maui showed them all the wonders of spirit world; and when at length their curiosity was perfectly satisfied, he conducted them back to the upper world of light, to which they all properly belonged."[*]

The last version of the story to be compared is that from the Marquesas. It is, in composition, extremely rough and primitive.[†]

"Mahuike, or Mauike, 'goddess of fire, of earthquakes, and volcanoes,' dwelt in Havaiki. She had no child but one, a married daughter who lived on earth: that daughter was the grandmother of Maui. Maui lived with his father and mother upon the promontory of an island, the name of which is unknown.

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[*] "Myths and Songs," page 63, *et seq.*

[†] I present the following lines as an example, with a literal interlinear translation :—

"*Aitu mea ma to Maui kite te kui heke i Havaiki.*
"The breaking-tapu affair by which Maui saw his mother descend to [Hawaiki.
To Maui tata i te kui,
Maui near his mother.

To te kui kite—uaua to ue i te tama i te oioi.
The mother looked—poured out tears on the child who slept.

Te tama tivava te hiamoe.
The child lied (pretended) sleep.

Tekao i te tama, Maui?" Te tama aoe tekao : hiamoe tivava.
Said to the child, "Maui?" The child did not speak: shammed sleep.

Te vahine tekao i te vahana, Aue! hakavaa.
The woman said to her husband, "Alas! he wakes!"

To te vahine tekao, Aue! taa au!
The woman said, "Alas! he sees me!"

Vahana tekao, "Aoe; Maui hiamoe."
Husband says, "No; Maui sleeps."

To te vahana tekao i te vahine, "Amai."
The husband says to his wife, "Let us go."

To te kui me te metua putamai aanui mea oa.
The mother, with the father, went towards the road—a distant thing.

Te kui kukamai veinehae to te kui to ia."
The mother thought spectre of her mother." Etc., etc.

He was an only child (*poiti*). He had already pondered over the want of fire, and he was tired of eating his food raw. The frequent absences of his parents during the night perplexed him; he was convinced that they went to get fire, for they always had cooked food. On one occasion his mother said to him, 'Child, remain here; I shall return soon.' 'I want to go with you,' said the child. 'You cannot, pet (*poiti*); I am going to seek for fire.' Said Maui, 'I want to go also.' His mother said, 'Your ancestress will kill you if you follow me.' When the mother went, the child followed afar off. Near the entrance to the path which led to Havaiki the mother was stopped by a bird, perched upon a *kaku* tree;* thinking that it was a *patiotio* (a bird now *tapu* in the Marquesas), she called her husband, and they threw stones at the bird. They could not strike it; and the woman conceived the idea that it was the form of her grandmother concealed within the bird. From this notion she was dissuaded by her husband, and they continued to throw stones, till at last they struck the winged intruder. Maui then spoke through the bird and declared his identity. The parents went on towards Havaiki by a long and winding road, the mother chewing a stick of sugar-cane as she went. Maui also penetrated through the aperture where commenced the path to the nether world; but almost at his first step perceived his grandmother, who guarded the entrance. He begged her to let him pass, but she refused to do so, and was hardened against all his entreaties. Maui asked where his mother had gone, and was answered that she had journeyed into the interior of the country. Maui, finding that she was obdurate, and would not permit him to pass, killed her. At that moment some spots of blood fell on the breast of Maui's mother as she journeyed along; and she said to her husband, 'Someone has killed my mother.' Maui, finding no further obstacle, descended into the bowels of the earth and went on his way. Not far on he met his mother, coming back. When she saw him, she said, 'What have you done? You have killed my mother.' 'Yes,' said Maui, 'she would not let me pass; I want to get fire, and I am determined to obtain it.' His father said, 'Do not kill or injure the old goddess.' Maui promised that he would not, and then went on till he arrived at the dwelling of Mauike. Maui said to the fire-goddess, 'Give me some fire.' The answer came: 'Is it for you?' 'No,' said Maui, 'it's for your daughter.' The old woman replied, 'Why do you come for it? What do you want with it?' Maui said, 'I want to cook some bread-fruit.' The goddess asked him to get her some husk of cocoanut. He procured this, and she then gave him fire drawn from her toes. There are several kinds of fire:

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* This is the only tree in Nukuhiva the wood of which does not ignite by friction.

fire drawn from the knees, from the navel, etc.; of these the worst kind is that taken from the feet or legs; the sacred fire is from the head. So Maui took this fire which had issued from the toes of Mauike, and quenched it in some water. Then he returned, and asked the old woman for more. She took the cocoanut husk, and this time drew fire from her knees; this she gave to Maui, who took it away and extinguished it, as he had done with the other fire she had given him. Maui went back, and asked again. The fire-deity said: 'You fatiguing child, you wicked boy, what have you done with the fire?' 'I have fallen into the water, and hurt myself,' said Maui. Maui then received fire from her back; this he put out. Then she gave him the cocoanut husk ignited with fire from her navel; this also he extinguished. The goddess then became violently angry, and put on a most terrifying and awful aspect, a lurid and unearthly spectral form. But Maui was undaunted, and said: 'I know all the secrets of witchcraft, and care nothing for your magical powers;' then he took a sharp stone, and with it he cut off her head. Maui then returned to his parents, and told them what he had done. They were very angry, and lamented the death of their great relative. Maui then took the fire he had obtained: he did not at first understand its properties, but tried to kindle stones, water, etc.; at last he tried trees, and kindled the *fau* (*Hibiscus*), the *verai* (cotton-wood), the *keika*, *aukea*, etc., and all trees, except the *kaku* tree, on which Maui had rested when he took the bird's shape."

These are the principal legends I have been able to procure on the subject of the origin of fire, or the art of procuring it. These traditions share in a general groundwork, and in the most important points of interest. The scene is laid in Hawaiki, and the path downward shows that *this* Hawaiki is no earthly locality, but the dim under-world of shadowy myth. There is, however, one very important difference between the New Zealand legends and those of the other islands: in the New Zealand story, fire is already in the dwellings of men; it is only when that fire becomes extinguished by accident (or, as in Maui's case, wilfully,) that it becomes necessary for one to proceed into the bowels of the earth in order to procure a new supply; and Maui's gift to man is not of fire whereby food may be cooked, but of the knowledge concerning the ignition of wood by friction. It would seem consistent, not only with the legend but with common-sense, that in the primitive days of the human race fire was already to be seen in the dwellings of men, ages before the art of procuring fire by friction of wood or by percussion of flint had been discovered. In very many parts of the world fire is to be found, not only during violent outbreaks of pent-up energy, as in volcanic eruptions, but issuing from rifts and fissures in the ground, and burning with steady and long-continued action. It would be easy to procure from such natural agencies sufficient fire to become the source of warmth to the body, and to ignite fuel for cooking food. This, too, may explain why it was necessary to go *downward* to regain the lost element; *below* was the great fire-source, plain to the sense of the primitive man as to our perceptions.[*] Whether the Maori race had its cradle in some land where such natural fires were procurable, has yet to be proven; but we must not forget that one of the most learned of our Polynesian scholars expressly affirms his opinion, that the Hawaiki of the Polynesian race (whether as source, or as temporary resting-place,) was a land near a great volcano. Judge Fornander, of Hawaii, considers that Hawa-iki was a name of Java (*Hawa*), translating *iki* in its South Marquesan sense, as "raging, furious with heat;" and then the author quotes from an ancient Marquesan song concerning this Hawaii, or Hawaiki: "*Tai mamao, uta oa tu te ii*"—"a distant sea (or far-off region), away inland stands the volcano."[†]

The Island of Hawaii (Sandwich Islands) may also have been thus named, after the prior locality, by reason of its great volcano, *Kilauea.*

It would seem that no such tribal or racial locality of birthplace is necessary to account for the use of fire before the discovery of its production by the friction of wood. The classical form of the fire-raising story, as given by the oldest Greek and Latin writers, has many resemblances in detail to the Polynesian tradition. Prometheus was, like Maui, not only "the *thief* of fire from heaven," but also, like Maui, "surpassed all mankind in cunning and fraud" (Lempriere). This, however, does not detract from the excellence of their character in the eyes of our simple forerunners; cunning, like that of Odysseus, had its fair share of admiration; in the words of one of our distinguished critics of Greek literature, "Even the highest conception of deity in Homer does not exclude the element of fraud."[‡] This cunning displayed itself in Prometheus by his deception of Zeus, when the choice of sacrifices was offered; and it was on account of this sacrilegious disrespect that Zeus *took fire away* from the earth. Thus it would seem, from the legend, that Prometheus, like Maui, only *recovered* the fire which had disappeared from the world. Again, Prometheus brought the sacred fire back to men "at the end of a *ferula*," a phrase almost certainly meaning the end of the pointed rubbing-stick used for procuring fire.[*] The wisdom or "cunning" of Prometheus was used for the good of men: he taught us to build cities, to use letters, to tame for service the ox and horse, to cull herbs for medicine, to navigate the sea, etc.: as, on his part, Maui proved himself a benefactor to his race by lengthening the days, (in noosing and "slowing down" the sun's too-rapid course,) in drawing up land from the ocean, and in sacrificing himself to the Great Daughter of Night (*Hine-nui-te-Po*) in the attempt to gain immortality for men.

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[*] *cf.* Tongan *mofuike*, "earthquake," with *Mafuie*, "the fire-goddess."

[†] "Polynesian Races," vol. i., p. 6. I, however, think *ii* is equivalent to Maori *riri*, "angry," the Marquesans dropping the *r*, but not *k*; *ii*, then, is not *iki*.

[‡] "Juventus Mundi," by the Right Hon. W. E. Gladstone, p. 208.

It is difficult to get at an accurate idea of the true parentage of Maui, if we view the whole story, not as a solar myth, but as a tradition concerning an actual personage, round about whom the mists of mythology have collected. We have, in the tales I have brought together in this paper, several different accounts of his birth and parentage. In New Zealand, the most reliable legends give Taranga as the mother, and Makeatutara as the father. In Samoa, Ti'iti'i is the hero, and Talaga (Taranga) is his *father*. In Mangaia, Ru was the father[†] and Buataranga (Bu-a-taranga) the mother of Maui. In Manihiki, Maui's father is Manuahifare, and his mother Tongoifare. The Marquesan legend does not give the name of either parent. In the Ulu genealogy of Hawaii,[‡] which contains the names of many of our New Zealand heroes, etc., we find Mahuika, the fire-goddess (as Hina-mahuia), falls into her proper place as Maui's grandmother, being in the twentieth generation (so-called) from Wakea (Vatea, Atea, "Daylight") and Papa, ("the Earth,") the primal pair. Mahuika's *son* is called Akalana, (A-Taranga, or Ka-Taranga,) and his wife is Hinakawea, their son being Mauiakalana, (Maui-a-Taranga,) our Maui. In some islands where Talanga or Taranga is neither father nor mother, it is he himself who procures fire; while the hero Ti'iti'i, of Samoa, in New Zealand becomes only the top-knot (*tikitiki*) in which Maui's mother wrapped the boy soon after his birth. I think it highly probable that our version concerning Maui being so wrapped up is a local addendum engrafted on the original story, as an effort to explain etymology of an obscure term—a source of mythology from which has flowed a constant current of legends; this especially, as none other of the Polynesian accounts allude to it, so far as I can find. Tiki is a venerable name in the Pacific. In New Zealand, Tiki appears either as the Creator of man, or else as himself the first man created by Tane; and his carved

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[*] "Hid in a hollow cane the fount of fire
I privately conveyed, of every art
Productive, and the noblest gift to man."
Æschylus.—"Prometheus Bound.'

[†] In New Zealand, Ru is the earthquake-god. In Tahiti, Ru is the brother of Hina, and is either Rupe or Maui himself.

[‡] Fornander, *loc. cit.*, page 191.

simulacrum was the most widely-diffused religious emblem in these islands, *tiki* being used as a common name for all such carvings. To the farthest bounds of Eastern Polynesia the same cult extended. Moerenhoüt, writing of Easter Island, says that on visiting the little island of Ravaivai he there found precisely similar statues to those of Easter Island, and they were in the same neglected condition. The figures, like those at Easter, Libuai, Pitcairn, Tubuai, etc., were raised on platforms at extremities of the low lands. The natives called them *Tii-one* and *Tii-papa*, (*Tiki-one* and *Tiki-papa*,) "guardians of earth and rock;" in fact, the Latin *Termini*. They were, apparently, not gods of the highest order, but *tikis*, marking boundaries, and keeping the limits of gods and men, dead and living.* A Marquesan legend also states that Tiki was the name of the lord or chief of the canoes when the migration from the westward arrived at Nukuhiva: his name appears in the genealogies of all Polynesian peoples.†

Before quitting this part of the subject, it would be well not to forget that Taranga's personal identity is somewhat shaken by the Hawaiian tradition that the land whence the Polynesians came was called *Kahiki-ku* (in Maori letters, *Tawhiti-tu*), or "the large continent to the east of Kalana-i-Hau-ola," or "the place where the first members of mankind were created."‡ This last-named place would read in Maori as *Taranga-i-hau-ora*, or "Taranga with the life-breath;" and would make Maui's mother (or father) a mere locality-name, although of a very sacred character. According to Mr. John White, the *Hau-ora* (or *Wai-ora*) is the name of the third heaven, and is the place whence the spirit of a man comes to him at birth.* There is also a curious coincidence in *Tiki* being "the Creative Being," or "the first created being;" and *Taranga* (*Kalana*), "the place of creation," while Maui unites both in his title—*Maui-tikitiki-a-Taranga*.

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* See "Les Polynesiens," Lesson, p. 294.

† It would also seem that, in comparison with the New Zealand words: *tiki*, "a deity;" *tikitiki*, "a top-knot," etc., we should consider as a variant our *tiketike*, "high, lofty:" the Samoan *ti'eti'e*, "to be seated on high;" the Hawaiian *kiekie*, "high, lofty, exalted, holy;" the Tahitian *faa-tietie*, "glory, honour, to boast," etc.; this concurrence appearing to show a radical (√ TIK) implying a supreme chief and leader. As a possible explanation, I therefore offer a suggestion (and a suggestion only) that Maui's title implies that he was the leader of the Polynesian expedition into the Pacific. *Ka* is Hawaiian for the definite article "the" (which in Maori letters would be *ta*, perhaps an old form of *te*); thus, *Maui-Tikitiki-a-ta-runga* would mean "Maui, Chief of the Fleet." In Sanscrit, *taranga* means "a waving, a motion to and fro;" *tarana*, "a raft or boat"—both these evidently connected with *tara*, "who or what passes over or beyond; passing over; a crossing; a passage"—thus giving an Asiatic value to this word as signifying "migration." I offer this idea to those of the realistic school who abhor the solar myth theory; the "Euhemerists." (See "Primitive Culture," Tylor, vol. i., p. 252.) On the other hand, to their opponents, I offer a possible explanation of Maui's name as perhaps meaning "Light-seeker," *Ma-ui; ma*, or *mah*, being a very widely-spread name for "light" in the ancient world, and *ui* meaning "to inquire." It would be a most appropriate name for our fire-seeking hero.

‡ Fornander, *loc. cit*, p. 28

A remarkable variation of the parent-name is given in the Manihiki legend, in which Maui's father is called Manuahifare. Literally, the name means "Bird-fire-house," and this gives a wonderfully succinct and abbreviated *precis* of the whole story. But *manu* means not only "a bird," but something of far greater consequence: it means "a spirit"—sometimes a spirit incarnate in the bird, but also sometimes a spirit in its invisible possession.†

Thus, in the Mangaian story of Ina,‡ "a divine spirit (*manu*) entered and took possession of Ina;" and again, "it was the might of Tinirau that inspired her with a *manu*, or strange spirit."§ Maui became either a dove or a hawk when on this adventure in search of fire. In Mr. Wohlers' fire-getting tradition (before spoken of), Maui is a dove when seeking the fire, and a hawk when returning; and Mr. White especially notices that the hawk was the child of Mahuika (as Maui was), and itself the god of fire. We must look to very ancient beliefs for explanation, if we wish to find out why Maui assumed the bird-dress when descending to the bowels of the earth, and why this bird-dress was that of the dove. I have already called attention, in the story of Hina, to the similarity between the transformation of Maui and his brother Rupe into doves having Aryan affinities in the Teutonic stories of swan-maidens, dove-maidens, etc.||

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* "Ancient History of the Maori," vol. i., Appendix.

† The Polynesian use of the word "*manu*," as any animal, beast, reptile, insect, etc., appears to be generally a modern corruption. The primal meaning, "to float," shows its inapplicability to any such bestowal.

‡ See "Hina's Voyage to the Sacred Isle," "Trans. N.Z. Inst.," vol. xix., p. 498.

§ *loc. cit.*, p. 495.

|| *Philological.*—The word *rupe*, a general Polynesian word for the pigeon is probably connected radically with the corresponding Aryan words. The old English words *cushat*, "a wood pigeon," and *cooscot*, "the wood-pigeon," ("Obs. and Archaic Dict.," Wright, vol. i., p. 339) seem mere sound words, like the Cumberland *coo*, "to call," and are probably connected with the pigeon's note, as are the Hawaiian *kuhukuhu*, "a dove," and *nuunuku* (*manu-ku*), "a dove;" the Samoan *'u 'u* (*kuku*), "to cry as a child;" Tongan *kulu-kulu*, "a small kind of dove," etc. The English word "dove" (Ang. Sax. *dufa*) is from the Old Saxon *duva*; Old High German *tuba*, the German *taube* "a dove" (Skeat, "Ety. Dict."); the original sense meaning "to dive" (*dufan*), from the bird's habit of ducking its head. This would show the reason philologists have for associating the Latin *columba*, "a dove," with the Greek *kolumbao* (κολυμβάω), "I dive." It may, perhaps, be worthy of attention to consider whether another Latin word for dove,

But the choice of this form for a deity or demi-god, especially in the fire-gaining story, goes deeper still:—

(Egypt.)—"The spirits wore the forms of human-headed birds. The bird was an emblem of breath, or soul. The breath was the mover to and fro in the body; and in death, its types—the bird and the feather—were clung to as emblematical of the spirit. . . . The dove was retained in Israel as the bird of breath, the type of the soul. In the Osirian cult, the hawk was the symbol of the soul. The sun was depicted with the hawk-head, but in the 12th chapter of the 'Metamorphoses,' Ritual 76–88, the turtle-dove is one of the types into which Osiris, the deceased, makes his transformation."*

I think it, therefore, by no means a mere story-teller's fancy that gave to Maui first the dove-shape, then that of the "hawk of soul," or fire.

That certain trees should have been selected by the Polynesians (differing in each legend according to the vegetable growth of the locality) as those into which "the seed of fire" was placed by Maui, is but natural; it would not escape the observation of the shrewd natives that certain kinds of timber were more inflammable than others. But the expression "seed of fire" is remarkable as being an idiom preserved among

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palumba, or *palumbe*, if placed beside *columba*, does not show that the original part of each word is *lumba* (*pa-lumba*, *co-lumba*). In Aryan languages *m* and *p*, or *m* and *v*, or *m* and *b*, interchange continually: the Celtic *mor* and *vor*, "great;" Welsh *moel* and *foel*, "a hill;" Irish *mean* and *bean*, "a woman;" Latin *tumeo* and *tubeo*, *glomus* and *globus*; as familiar examples in English, *Molly* and *Polly*, *Meg* and *Peg*. But this interchange points to a probable indistinct, primitive, double consonant *mb* or *mp*. sounds so often found in simple languages, where, instead of getting distinct letter-sounds, we have highly complicated ones, like the Hottentot clicks, etc., the *tch*, *ng*, *mb*, etc. The Fijians (Melanesians) have this ancient compound consonant *mb*. every *b* is *mb*; thus the word we write *Bau* is pronounced *Mbau*, *Bulotu* is *Mbulotu*, etc. In the Polynesian dialects the *m* and *v* or *m* and *p* constantly interchange (*mavete*, *wewete*; *mafao*, *fafao*; *malemo*, *paremo*; *milo*, *wilo*, etc.), though they cannot say *mb*. If, in the case of the "dove" word, the Latin has kept this ancient consonant, then *pa-lumbe* and *co lumba* become *pa-lube* and *co-luba*: this *lube* equalling the Tongan *lube*, the Samoan *lupe*, the Tahitian *rupe*, *i.e.* "pigeon." If, on the other hand, this derivation or comparison is not upheld on further investigation; should it be made certain that *columba* means "the diver," as *κολυμβάω* (*palumba* remaining unaccounted for), then this side of the meaning shows itself also in the Maori languages. The German *taube*, "a dove," with its meaning "to dive and duck the head," (See Kluge, "Etymologisches Wörterbuch,") is in Maori *taupe*, "to bend down," "bending the head," variable; in Tahitian, *taupe*, "to bend down," applied to the head; in Tongan, *taube*, "to bend down;" in Samoan, *taupe*, "to swing." And this meaning of swinging, bowing or bending the head, is plainly connected with the *lube* (*rupe*) pigeon-word; for while in Tongan *lube* means "pigeon," *lubelube* is "to swing, or swag," as in carrying anything along.

* "Book of the Beginnings," Massey, vol. ii., pp. 92, 93. See also former paper, "Polynesian Alphabets," Tregear (p. 358, *ante*).

Europeans, and with curious word-relationships in Polynesia. As examples of European use, I may quote the "Legendary Fictions of the Irish Celts," by P. Kennedy :—

"Just as the plough-irons were becoming red-hot, someone tried the latch of the door, and immediately they saw the face of the witch outside the window. 'What do you want, good woman ?' 'The *seed of the fire*, and I want to help you at the churning,'" etc. (p. 152.) Again, "But every Holy Eve during their lives they threw the water out as soon as their feet were washed, unbanded the wheel, swept up the house, and covered the big coal to have the *seed of fire* next morning" (p. 165).

In the sacred books of the ancient Persians the same idea may be found. The xviii. Fargard of the "Vendidad" (Zend-Avesta), 52 (112), says : "Then shalt thou call his name 'Fire-creature,' '*Fire-seed*,' 'Fire-offspring,' 'Fire-land,' or any name wherein there is fire." Thus it would appear that "fire-seed" was an idiom well-known to both the European and Asiatic branches of the Aryan stock. In Maori the word *purapura*, meaning "seed," is evidently connected in some way with "fire." In New Zealand, *pura* does not mean fire; but in composition it does so, as may be seen in *kapura* and *mapura* (*ka-pura* and *ma-pura*), both words for "fire."* In Hawaiian, *pula* means "a small particle" of anything, as dust; *pulapula* is (1) "the tops of sugar-cane cut for planting," (2) "a devotee," (3) "anger," "revenge;" in this dialect the connection both with "seed" and "fire" has been weakened. In Samoan we have *pula*, "to shine," "to be yellow," as ripe fruit; but in Tahitian we have the fullest sense on both sides of the word: *pura* means "a spark of fire," "a flash of fire or light," "to flash," "to blaze;" *purara*, "dispersion;" *faa-purara*, "to scatter," "spread abroad;" *haa-purara* (*whaka-purara*), "to make sparks fly," "to spread abroad," "a disperser." It seems almost certain that the sowing, scattering abroad as of seed, is the scattering of sparks, the "fire-seed" in its original sense. I have in a former paper ("Hina," etc.) expressed my belief that the Maori *ura*, "to glow," is from the original world-spread root *ur*, *or*, *aur*, etc., used all over the ancient world. I find that certain scholars consider that the Latin *uro* had originally a *b* before it, from the words found in composition, as *comburo*, *amburo*, *bustum*, etc. I do not think that this is altogether proven, as I believe the root *bur* to be *ur* with the digamma sound prefixed; but should it prove to be the case, then *buro* compares with the Greek *pur* or *pyr* (πῦρ), "fire," and is a sister of the Polynesian *pura*, "fire." There is a clear connection between gold and sun-worship; gold, the *or* (*aurum*) of old days: "The sacredness of gold seems indicated by Pindar, who, invoking Theia, the mythical mother of the sun-god, exclaims: 'Through thee it is that mortals esteem mighty gold above all things else!'"[*]

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* *Mura*, *mumura*, etc., "to blaze," is the *m* to *p* (the *mb* or *mp*) variant.

Mr. Robert Brown, F.S.A., in his learned and interesting treatise, "The Myth of Kirkê,"[†] remarks: "The links between gold and solar divinities are endless, and the circumstances supplied a natural basis for the commercial value of the metal." Elsewhere the same writer observes:[‡] "The bright solar divinities are, of course, rich in gold, a metal originally owing its importance to its yellow (sun) colour, which made it at once semi-sacred and symbolic long ere it received an artificial commercial value."[§]

None of the radicals in classic languages show the etymological relation between sun and gold, but the Maori *ura*, "to glow," discloses the *ra* of *Ra*, "the sun," with the *ur*, "shining, glowing," word. I do not by this mean to imply that the Polynesians were acquainted with gold (though no one can disprove even this), but I think that there is a high probability that the word, *in its Polynesian form*, was applied to that metal when discovered and used by men in Central Asia.

In referring to the "Cosmogony of Sanconiathon," said to be a history from the sacred books of the Phœnicians, after mentioning how *Phos*, *Pur*, and *Phlox* (Light, Fire, and Flame) made the discovery of fire by rubbing wood, Mr. Blackett says:[||] "And Usous having taken a tree and broken off the boughs, made a boat, and first ventured on the sea. And he consecrated two pillars to 'fire' and 'the wind,' and worshipped them, and poured out upon them the blood of wild beasts which he took in hunting; and when these men were dead consecrated rods to them and worshipped the pillars." This is a singular coincidence of ancient ceremonial with that of the Maoris; they in their worship setting up rods (*mauri* or *toko-mauri*) in their small temples or shrines (*tuaahu*). If the pillars were set up to "Fire" and "Wind," a similar word to the Maori *hau*, "wind," was probably used (*hau* was a very common word in old Maori incantations, as *whangai-hau*, etc.), some cognate word being used ages ago in Asia: "I there drew attention to the Assyrian name for 'wind,' *aiv* (*haiv*), *au* (*hau*), root √ 'to blow.'"[¶] And the pillar to Fire, if not called *pur* (see Blackett, *l.c.*), *πυρ*, or *pu-ra*, would also probably be called *ra*, as even to-day in Central Asia this word obtains. Referring to pillars made of stones placed on each other in regular order, it is said: "This emblem is also to be found in China and Thibet inscribed with Sanscrit letters, which serve further to designate the parts. Thus the lowest, marked *a*, means the 'earth;' the circle, *va*, stands for 'water;' the triangle, *ra*, 'fire.'"* (Maori, *cf.* *ao*, "the earth;" *wai*, "water;" *ra*, "sun.")

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[*] Pind. Isthm., iv., 1.

[†] Page 159 (Note).

[‡] "Eridanus," p. 49 (Note 4).

[§] "Gold-worship," Dr. F. A. Paley, "Contemp. Review," Aug., 1884, p. 271.

[||] "Lost Histories of America," p. 104.

[¶] "The Cuneiform Inscriptions and the Old Testament," Eberhard Schrader, p. 25.

The *ura* word descended from antiquity into the most common of those Aryan myths which have given us such lovely stories as the bases of classic poetry. If the theory of the solar mythologists is correct, the myths of the Dawn, and of the Sun chasing the Dawn and conquering the Darkness, are the foundations of the greater part of our pre-historic legends. Max Muller says: "Hence we find that names beginning with *uru* in Sanscrit and with *ευρυ* in Greek are almost invariably names of the Dawn, or Twilight.† Names of the Dawn are Euryphaessa, the mother of Helios; Eurykyde, or Eurypyle, the daughter of Endymion; Eurymede, the wife of Glaucus; Eurynome, the mother of the Charites; and Eurydike, the wife of Orpheus."‡

But side by side with the polished versions deifying the shining light, existed an actual worship of the sun and fire deities which we are not accustomed to consider as descending to almost modern days. We are apt to forget that the Romans, though acknowledging a whole pantheon of deities, (and not absolutely fire-worshippers in the sense in which the Parsees are thus to be considered,) paid the very greatest respect to those fire-deities having charge of the domestic hearth—the Vesta, or Hestia worship; the devotion to the Lares. It may be urged that the Lar-worship was entirely a worship of the spirits of ancestors, however cloaked under differing names—as the Genius, Lares, Penates, Vesta, or Manes. The *pitris*, or "fathers," were worshiped by the Sanscrit-speaking peoples, the *Sama-Veda* being devoted to the ceremonial directions. The old Slavonians also paid their devotion to the ancestral spirits: "There is no doubt as to their belief that the souls of the fathers watched over their children, and their children's children; and that, therefore, departed spirits, and especially those of ancestors, ought always to be regarded with pious veneration, and sometimes solaced by prayer and sacrifice."§

Dr. Shortland has very ably‖ shown the close parallelism between the worship of the *manes* and of the Maori ancestral spirits; but there is more in the subject of interest unexhausted, particularly the connection between the house spirit and fire. "In the "Avesta" (Spiegel's "Avesta," by Bleeck, vol. iii., p. 181), Asha-Vashista, the genius of fire, is designated as "the house-companion of human beings." The Latin writers use "hearth" and "*lar*" as synonymous. Virgil* uses the terms "*Lares*" and "*Penates*"† indifferently, as the verse happens to require, and habitually associates the house spirit with the fire on the hearth, and the "*canæ penetralia Vestæ.*"‡

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* "Tree and Serpent Worship," Fergusson, p. 115.

† *cf.* Maori *uru*, "the west."—*E.T.*

‡ "Chips from a German Workshop," vol ii., p. 112.

§ "Songs of Russia," Ralston, p 126.

‖ "Maori Religion and Mythology," chap. i

"'The true temples of the Etruscans,' it has been observed, 'were the tombs' (Taylor's "Etruscan Researches," p. 49); practically, the real objects of their worship were the *Lares*, or spirits of their ancestors. Each house had its *lararium*, where the master of the household offered prayer and worship every morning, and sacrifice occasionally. In the Theodosian code it was provided that no one should any longer worship his *lar* with fire (*nullus Larem igne veneretur*)."§

"Men worshipped the house spirit on the hearth at a time when they perfectly understood that *Dyaus* meant 'the blue sky,' and that *Varuna*, or *Ouranos*, was 'the arch of heaven.' Centuries after the common apartment of the primitive house had disappeared, and separate rooms were assigned in spacious mansions for the purpose of domestic life, the old altar, the symbol of the holy hearth, survived, as the houses of Pompeii still show, undisturbed, in the atrium. All the changes of thought and feeling which marked the rise of the empire were impotent against the *Lar*. Horace, Ovid, Petronius, (See "La Cité Antique," p. 24) free-thinkers in principle and sensualists in practice, duly celebrated the worship of the hearth."||

Even when the ancestral spirits had been degraded into mere domestic goblins and pixies, it was with the hearth they had special connection. Speaking of the German House-Spirit, the *Kobold*, Grimm¶ says: "We can often trace in them a special relation to the hearth of the house, from beneath which they often came forth, and where the door of their subterranean dwelling seems to have been: they are peculiarly hearth-gods."

From these examples, it will be clearly seen that if the Aryans were not fire-worshippers, pure and simple, they paid

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* Æneid, v., 743, and ix., 259.

† In *lar*, probably, the vowel sound *ā* has been broadened from *la* to *lar*. If so, then compare Maori *ra*, Hawaiian *la*, Tongan *laa*, all meaning "the Sun;" also with *penates*, "the care-takers." (*cf.* the Maori *pena*, "to take care of," "to cherish.")

‡ "The Aryan Household," W. E. Hearn, p. 51.

§ "Religions of the Ancient World," G. Rawlinson, p. 194.

|| Hearn, *loc. cit.*, p. 56.

¶ "Deutsche Mythologie," vol. i., p. 468.

somewhat of adoration to that element, and to the *θεοι ἐφέστιοι*, or "gods of the hearth." This comes out most strongly in the accounts of the religious ceremonies wherein the fire—the "new-fire," or "need-fire," *agni*, or by whatever name called, was born from the friction of one piece of wood against another. "Emile Burnouf, in his excellent work, "La Science des Religions," just published, says: 'The 卐 (*swastika*) represents the two pieces of wood laid upon one another before the sacrificial altars, in order to produce the holy fire (*agni*), and whose ends were bent round at right angles and fastened by means of iron nails 卐 so that this wooden scaffolding might not be moved. At the point where the two pieces of wood were joined there was a small hole, in which a third piece of wood in the form of a lance (called *pramantha*), was rotated by means of a cord made of cow's hair and hemp, till fire was generated by friction. The father of the holy fire (*agni*) is Twastri, *i.e.*, the divine carpenter who made the *swastika* and the *pramantha*, by the friction of which the divine child was produced. The *pramantha* was afterwards transformed by the Greeks into Prometheus, who they imagined stole fire from heaven, so as to instil into earth-born man the bright spark of the soul. The mother of the holy fire is the divine Maja, who represents the productive forces in the form of a woman;[*] every human being has his *maja*. Scarcely has the weak spark escaped from its mother's lap—that is from the *swastika*, which is likewise called mother, and is the place where the divine Maja principally dwells—when it, *agni*, receives the name of child."[†]

It is of interest to note that the name given as that of the Father of Fire is Tvastri (spelt sometimes Tvachtri, Twachtrei, etc., by European writers). The word means "a carpenter," and is referred to as possessing this meaning by many philologists and mythologists, such as Kuhn, Max Müller, and others. It is Tvastri who forges the thunderbolts of Indra, and all the different implements peculiar to the deities of Hindustan, but he is sometimes regarded as being himself the Creator. That he, as Creator, was spoken of by such a title as "the Carpenter" is certain, since so many eminent Sanscrit scholars declare this to be the fact; but I cannot believe that any such mode of thought was even possible to a *primitive* people. A nation must have advanced a long way up the scale of progress and improvement for an artisan, working either in wood or metals, to have existence, much more for the name to have acquired honour as an appellative. We must look back through these misleading mists of civilization to try and catch some glimpse of a race just emerging from the deepest barbarism, unacquainted with any forces except natural forces; and it is among the names of these natural forces that we should look for that of the great Father of Fire. I believe that a suggestion which I now make will receive very grave consideration, in regard to the meaning of this name of Tvastri. The effects of *lightning* were not known to the ancient world: it was the thunder in which mischief was supposed to reside: the thunderbolt from the hand of Jove, of Indra, or of Perkunas. That the Thunderer, the wielder of Celestial Fire, should be father of the earth-born fire caused by the friction of wood, would be in perfect keeping with all we can imagine of applicability in the primitive mind. That the word might afterwards grow to mean "artificer" or "workman" (in a secondary or tertiary sense) is possible; but that the Creator and the Wielder of the Thunderbolt should be considered as one and the same person is not only highly probable, but we have direct testimony from Oriental and European classics that such was the case. We should look, then, to a language having internal evidence of simplicity, if we seek for simple names of natural forces, and we shall find no such language for our purpose so good as the Polynesian, the untainted speech of an isolated people. Here we have the thunder-deity as Whaituri, or Whatitiri. Is it possible to trace a phonetic connecting link between Tvastri and Whaitiri? If we turn to a comparative table of Polynesian dialects, in the Appendix to Mr. Turner's "Samoa, a Hundred Years Ago," we shall find a very close link. In the Island of Vaté (or Fate), lying in the track between us and Asia, the word for thunder is *vatshiri*. The connection between *Whaitiri*, *vatshiri*, and *Tvastri* must be undoubted: an important point being that only in Maori is the etymology of the word transparent.*

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[*] Maja, Maia, or Maya. *cf.* the Tahitian *maia*, "a midwife," and Maori *maea*, "to emerge."

[†] "Troy and its Remains," Schliemann, p. 103.

To return for a short time to the fire-cross. Mr. N. Joly† says: "In his interesting work upon the origin of fire ('*Die Herabkunst des Feuers*') Adalbert Kuhn always designates the *swastika* [shown with two different diagrams—*E.T.*] by the name of *arani*, and he considers them both as the principal religious symbols of our Aryan ancestors." He adds: "This process of kindling fire naturally led man to the ideas of sexual reproduction.[*] This is what we see in a hymn of the 'Rig Veda,' where the *pramantha* evidently represents the male," etc.[†]

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* The Malay, who has many Sanscrit words (most of late introduction, with the Brahminical, Buddhistic, etc., religions), calls the thunder *guruh*. This word is probably akin to the Tongan *gulu*, "to make a muttering, grumbling sound;" in New Zealand Maori, *nguru*, "to rumble." If the Malay *guruh* is akin to the Sanscrit *gulu*, "great," "extended," it bears some relation to the √ *tan*, "stretched out," which philologists say is the origin of the thunder-words in Aryan. (See Skeat, "Ety. Dict.," p. 785; "Science of Thought," Max Müller, App.) *Tangi*, the Maori word "to wail, lament," is in the Tongan *tagi*, "to lament," but *tagitagi* is "stretched out to the uttermost."

† "Man before Metals," p. 189.

If we consider this *arani* symbol as a fact, we shall find significance in the words of Sir H. Rawlinson,[‡] when he says: "The primitive meaning of *ar* was 'fire.' . . . The Aryans generally appear to have been sun- or fire-worshippers, and probably they received their name from the fact. This would seem more probable than the ordinary derivation from the root *ar*, 'to plough;' and it would include the sense of 'noble' preferred by Mr. Peile, 'children of the sun' being usually a special title of the priestly or royal caste."

Can we find these *Arani* in Polynesia? I will take the evidence of the late M. Lesson.[§] He, quoting P. A. Lesson in the "Voyage aux Iles Mangareva," says that it is idle to attempt to give a date for the establishment of the Polynesian race on these islands. They report themselves as "a colony of immigrants descended from a great people called *Arani*." Who were these *Arani* from whom the Polynesians were descended? Is it certain that there is no connection between them and the Aryan users of the *Arani* "fire-symbol?"

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[*] I would direct the attention of Maori scholars to the fact (doubtless a very natural one) that the same idea of kindling the divine spark and of sexual reproduction obtains among the Maori races. *Hika*, the word meaning "to kindle fire by friction," also means "*coitus*," or did formerly possess this meaning. As an example, I may adduce the old legend of the arrival of the Tainui canoe in the Great Migration. [See Govt. pamphlet, G. 8, 1880: J. White.] The immigrant Maoris were unable to drag the canoe across the portage at Otahuhu, because the gods were angry on account of a sin committed by Marama, one of the chief women of the canoe, with her slave The others did not know the cause of the canoe remaining immovable until the chieftainess chanted a song in which occurred the words: "*Turuturu mai ra te wai o te hika o Marama*," a phrase by which, says the native narrator (Hoani Nahe, M.H.R.), her offence became known. Compare also *ahi*, "fire," and *ai*, "coitus."

[†] It is acknowledged that there is no certain derivation for "*swastika*." If the Maori, as I believe, has kept more truly than any others to the old Aryan or pre-Aryan speech, the meaning *may* be as follows:—The Maori, like the Persians, do not use the sibilant: *swastika*, without the two *s* letters, would be *whatika*: that is, in Maori, *whati*, "bent at an angle, or elbow," and *ka*, "to kindle fire." The *swastika* was a fire-kindling cross, with ends bent at angles.

[‡] "Jour. Anth. Soc.," vol. i., p. 366.

[§] "Les Polynésiens," vol. ii., p. 268.

ART. XLVII.—*The Aryo-Semitic Maori.*

[A REPLY.]

By E. TREGEAR, F.R.G.S.

[*Read before the Wellington Philosophical Society, 11th January,* 1888.]

IN the last volume of the "Transactions" (xix.) there appeared a paper under the title of "The Aryo-Semitic Maori," by Mr. A. S. Atkinson, of Nelson, on the subject of the origin of the Maori race, and my writings thereon. . . . I will attempt to answer, in as few sentences as possible, the main objections made by Mr. Atkinson.

First, as to the method, a method nicknamed "The Method of Insight." The writer says, in effect, that I claim that my system is a delightfully easy mode of derivation and interpretation, merely being the comparison of surface resemblances. If I stated that *for the reader* of my little book the result was easy to understand, it by no means followed that the work necessary to produce such results was easy in its process. It is averred by others, (who are followers of the "high and dry" school of philology, and who seem to think that all human knowledge has been digested and absorbed by themselves,) that any two languages may be compared phonetically and resemblances be found. If any one of these persons will take the 7,000 words in Williams' "New Zealand Dictionary" and compare them with, say Esquimaux, or Mexican, he will have no "delightfully easy" task. Better still, a language like the Tlatskanai (Athabascan), quoted by Canon Farrar, wherein *kholsiakatatkhusin* = tooth, and *kholzotkhltzitzkhltsaha* = tongue, when compared with Maori, would be a pursuit of no light character, although, as I said of my work, the *result* would be easy for the reader to follow.

Can it be proved that the phonetic method of comparison utterly fails? or that it fails at all? The more one learns, the more one reads, there comes one crushing dominating idea, the immense antiquity of the human race on the earth. Professor Sayce, who stands amongst the highest of authorities, says (in the last number of the "Journal of the Anthropological Society") that he once made a calculation as to the time since man had been a speaking animal, and he assigned forty thousand years. I must say I feel sympathy with another writer, who has said that those who are hunting for derivations in written records are but "scratching about on the surface" of human speech: words, as symbols of things, had their birth in ages compared with whose antiquity all books, all rock inscriptions, all alphabets and picture writings are but the work of yesterday. With deep reverence for the learned, devoted students of historical research, we must come to real philology at last, to the phonetic bases of the linguistic divisions into families—perhaps at last to the bases of linguistic unity. As a general rule, there can be little doubt but that languages which use the same sounds to express the same ideas are near akin, and from the same primal source. This has been the idea—and, in substance, the only idea—which has made philology possible: it was solely the likeness of sound and sense perceived between words of Hindostanee and words of European languages which wrought the discovery of the Aryan unity, although afterwards strengthened by other assistance, such as that of grammatical forms, etc. Further research has made it certain that many of these resemblances were not justifiable in comparison; nay, those persons who love paradox and exaggeration delight in stating that if two words resemble each other in sound and sense it is a proof that they are *not* connected. This would destroy the connection between the English "brother" and the Sanscrit *bhratri*, between our "stand" and the Sanscrit *sthá*—but such assertion really hardly needs denial. However we may track a word historically, we get to a dim twilight at last, in which we see the word being written down by an unknown scribe, in letters whose values differed according to the differing phonetic values assigned to them by this writer: briefly, this early penman, or rock-cutter, was then doing for his particular dialect yesterday what the missionary is doing in Polynesia to-day—*i.e.*, *writing by sound*; and it cannot be doubted that comparison between words in such a similar stage is very fairly permissible. Mr. Atkinson states that I take Aryan words in any period of growth, and compare those with Maori: I answer that in many cases I do this intentionally; with this much of reason,—that many words have scarcely changed to any extent within the historic period, and it matters little at what stage comparison is made with these. If I do not (or, rather, did not) give the oldest form, it was because I did not wish to cloud the sense of the passage by carrying the reader through strings of derivations, not always clear without long explanation. Had I taken the oldest form of the word obtainable, it would always have been to the advantage of the Aryan-Maori theory. Thus, I compared the Maori *hoko*, "to barter" (modern, "to buy or sell"), with the English "hawker," one who buys and sells; but the Teutonic words (German, *hoken*, "to higgle;" Danish, *höker*, "a huckster"), which have kept the old form better than the English, are also nearer the Maori. So with the English word "hook," which I compared with the Maori *hake*, "crooked." A Maori is perfectly able to say *huka*, and does use the word in a different sense, but does not mean a "hook" thereby: his word *hake* (√HAK), "bent," (compare *uhaaka*, "bent like a large hook," Colenso,) is akin to the word whence our modern form is derived, the Anglo-Saxon *haaca*, "a hook;" Dutch *haak*, Swedish *hake*, German *haken*. Again, I compared the Maori *hau*, "to chop," "to hew," with the English "hew;" but the German *hauen* (*hau-en*) is nearer to the Maori word. As to the derivations within the German itself, the same cousinship appears. The German *tau*, "a rope," is (as I said) the Maori *tau*, "a rope;" but in Kluge's "Etymologisches Worterbuch der Deutschen Sprache" the German *tau* is said to be connected with the English "tow," as a rope-making material; while the English *tow*, "to drag," has its Maori equivalent in the verb *to*, "to drag," "to haul," as a canoe, (*to-anga*, "towing;" *toanga-waka*, "a place where canoes are hauled up); the English and the Maori to be similarly spelt, if written down for the first time, to-day, by sound. I think that the accusation about "words of any period" being used to suit my convenience in comparison fails—it was to suit my convenience *as to brevity* that I took the familiar form.

Mr. Atkinson considers that I take too much latitude in regard to the letter sounds, instancing that I bring the Sanscrit *ve*, "to weave," into comparison with Maori syllables *we*, *whe*, and *whi*. There is great indecision in some of the Maori forms between *w* and *wh*. I could quote numberless instances where good Maori scholars (in past days) use *waka* for *whaka* (causative). I am often doubtful, in comparing Polynesian words, as to which is the oldest form, *h*, *wh*, *f*, *v*, *w*, etc.: in many cases the Maori *appears* to be wrong. Thus, *ahi*, "fire," should (by comparison with the Samoan *afi*) perhaps be written *awhi*; *hoe*, "a paddle," (in Samoan *foe*,) should perhaps be *whoe*—it being possible to distinguish the true *h* sounds because rendered by Samoan *s*: thus Maori *hau*, "wind" = *sau*: Maori *hoa*, "a friend" = *soa*; this question requires much consideration. That the Maori *whenu*, "the warp of cloth;" *whiri*, "to plait," Tongan *fifi*, "to plait cocoanut leaves;" Tahitian, *firi*, "to plait;" Hawaiian, *hili*, "to plait, to twist, to spin," may all be connected with a root *vi* or *ve*, "to spin, to weave," is very probable phonetically: the sound here seldom gets so far away from its radical as the European derivatives of the root *ve* or *vi*; examples given being *wine*, *withy*, *osier*, *vitis*, *ferrule*, *willow*, etc. (Skeat's "Etymological Dictionary"). As to the assertion that I represent Sanscrit *d*, *dh*, *l*, and *r* by the Maori *r*, that is also a fact: my plea being that the *English* sounds are thus represented in Maori. We translate the *D* of "David" by *R* of *Rawiri*; the *l* of "linen" by *r* of *rinena*: and both *l* and *r* in the word "glory" as *kororia*. What interpreters do in translating Aryan English into Maori letters is the only guide I have in thus comparing the Aryan Sanscrit with Maori sounds written in these letters.

The most amusing part of this objection appears when we consider its bearing on the Malay. Because a few words in

Malay resemble Maori in sound and sense, therefore, say the "high and dry" people, this is good enough to prove connection between these peoples. There is no proof that Malay *dua*, "two," is the Maori *rua*, "two," except sound-likeness; but if the student, conceding relationship, goes further, and expresses the opinion that the Aryan *dua*, "two," is also a near connection, there is a shriek of horror from the classical linguists. The grammarian cries "Impossible!"—quite ignoring the fact that rules of grammar mark mere stages in the progress of a language, and that modern English grammar is as far away from Sanscrit or old Latin as the Malay grammar is from the Maori, and that is a "far cry." For every Malay word traceable in the Maori vocabulary, the student can find twenty Polynesian words in the German Dictionary.

The objection that I split up a Native word as I choose is one that I defend, if in doing so I can prove that the probable radix appears more distinctly in that form. A greater or less complexity may be allowed to roots; but the more simple the form we use, the more we surrender the meanings possible to be expressed. I do not consider that the division according to the Native mode of so dividing a word would be the best way in which to arrive at the primal significance. Thus, if we take the word *patu*, "to strike," I consider that it may be treated under three distinct radical forms: that is, either as the third root √PAT, "to strike;" or, as the second, the more simple √PA, "to touch; or perhaps its most primitive form, √A, "to urge," "to drive." Whatever may be the vowel of direction or modification used to close the syllable in Polynesian fashion, the sound of √PAT or √PAK (the true dialectical interchange) carries the sense of "striking," "knocking," "pattering," "patting," "breaking," etc., in *patu*, *pata*, *patoto*, *patiti*, *patōtō*, *pakakū*, *pakanga*, *pakaru*, *paketu*, *paki*, *pakini*, *pakunu*, and *pakuru*. The sister-words in the Islands are multitudinous, but need not be quoted. I think this argument shows that, in spite of the natural divisions of a Polynesian word into distinct syllables, each ending with a vowel, a radical sense may extend itself over words like *pata*, "to drip" like water; *ripi*, "to cut;" *mano*, "the heart" (mental, not physical), *manawa*, "the heart;" *mana*, "influence, authority;" *maru*, "bruised;" *kite*, "to see, perceive," which would allow them to be referred to similar roots to those given (Appendix, Skeat's "Etymological Dictionary") as Aryan roots: such as √ PAT, "to fall," √ RUP, "to break," √ MAR, "to grind," √ MAN, "to think," √ KIT, "to perceive," etc.

Mr. Atkinson scores one point against me fairly enough: that in which he shows that my comparison of *kiri*, "the skin," with our *curry*, "to dress hides," is wrong. He does this on the authority of Professor Skeat, who states that *curry* comes from *courroyer*, the old French being *con-royer;* thus showing it to be a compound word conveying the idea of "to set in order." I yield the point, pleading that, at the time I wrote the paper containing this comparison, I had no copy of Skeat's "Etymological English Dictionary," and that I was relying upon two other Etymological English Dictionaries as references. In the first, Richardson's "New Dictionary of the English Language," 1855, the derivation of *curry* is given as through French *corroyer* from the Latin *corium*, "a hide," with the example: *i corium equi et dorsum fricare strigilli*, "to rub the hide of a horse with a currycomb." The other authority was Ward and Lock's "Standard Etymological Dictionary," 1880, in which *corroyer* is given as a derivative of *corium*. There can be little doubt that the French *cuir*, "leather," is connected with Latin *corium*, "a hide," Lithuanian *skura*, "a hide," Sanscrit *karma*, "a hide," Irish *creat*, "a hide:" all pointing to a common root √KAR or √KIR (KR) as their source, and thus being akin to the Maori *kiri*, "a hide." If we also consider the word *curee*, given by Brachet* as a hunting term for "pieces of skin, etc., thrown to the hounds," I think it possible that in the vulgar or provincial idioms unknown to literary men, a word "curry," meaning something to do with hides, or the skin, *did* exist in English, even by the side of such base compounds as *con-royer*. This may yet be found by English scholars to be the case, and the etymology reconsidered. From my correction by Mr. Atkinson a very useful lesson may be learnt, that is as to considering any Etymological Dictionary as a thing "made law by the Medes and Persians." If we compare our derivations to-day with those given only thirty years ago, note the discrepancies, and then picture our present works in the light of a century hence, the notion that we know all about everything—even about the impossibility of the Aryan-Maori theory—may be shaken.

Apparently the most serious argument used by Mr. Atkinson is that wherein he urges the Semitic side of the question, and uses my method in discussing it. Perhaps I am very dull and dead to fine raillery in not supposing it to be all pure wit, but I will take it for granted that Mr. Atkinson has not been mocking the Society too utterly by sending in a paper for publication without any seriousness in it at all. He first discusses the word "*Maori*," which he says is the same as "*Mauri*" (!) and asserts that the meaning is probably "living, not dead." He then quotes from Codrington's "Melanesian Languages" in support of this. I think that most Maori students will agree with me in declining to consider that *Mauri* and *Maori* are one word, or that the meaning of *Maori* is

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* "French Ety. Dict.," 1878.

"living, not dead," even if backed up by many Melanesians.* Williams' "New Zealand Dictionary" says that *Maori* means "native;" the "Tahitian Dictionary" gives *maori*, "indigenous, not foreign;" the "Hawaiian Dictionary" also gives *maoli*, "indigenous, native;" there is not the slightest reason for supposing the word refers to the *Mauri* or *Moors* of ancient history. Mr. Atkinson seems to have taken up (without acknowledgment) the late Rev. Mr. Taylor's idea as to the Moors and the Mauri, although Mr. Taylor's derivation of *mauri* (*i.e.*, *ma* + *uri*, as being the "black blood of the heart") would scarcely coincide with the sense of "indigenous, native," and would be rejected with scorn by the Maoris, if "Moor" and "blackfellow" be offered as the explanation of the national name of all the fair Polynesians. There is, however, a race of people whose ancient language, called Sanscrit, does contain the word, or one very like it. In Monier Williams' "Sanscrit Dictionary" we find *maulika*, "original," "radical;" *maulya*, "being at the root;" *maula*, "living from olden times or for generations in any country," "indigenous." This word thus agrees in sense, and nearly in sound, with the "*maol*" of the Polynesian *maoli*; "Moor" does not so agree, either in sound or meaning.

Mr. Taylor is a very curious guide for Mr. Atkinson to follow. I do not by this expression mean to decry Mr. Taylor's ability—it would be well if there were a few more men in New Zealand actuated by a spirit of inquiry and love of knowledge akin to his. But, as Mr. Atkinson says he has been a student of the Maori language for a long time, he must know that Mr. Taylor is a very doubtful authority. Mr. Atkinson says that one proof of the Maoris having known the *kava* root, as chewed for intoxicant, is that Mr. Taylor so considers, on the strength of a place named "Kawaranga!" This must be jest: the name of the place is correctly spelt "Kauwaeranga." In Mr. Codrington's book there is much that is of very great value, but it is not all of equal value. As a grammar, etc., of the Melanesian languages it is quite unique, and has won so much of praise for its author that it can afford a few points of dissent being raised without suffering. But when the grammar, etc., has been considered, and the author then theorizes outside the technical part, we are at liberty to totally dissent from that theory and the conclusions. The theory is that the whole of the Oceanic languages are (in base) one: Malay Archipelago, Madagascar, Papua, Polynesia, Melanesia, Micronesia—all the natives of these places speak one tongue. There are too many points of argument in the question to meet here, but I doubt if Polynesian scholars will accept any such theory. There is great persistence and no great difference in most vital Polynesian words: *rakau*, "a tree," for instance, is *lakau*, *raau*, *laau* in almost all the islands. But if we are to study Polynesian through Melanesian; if we are to find the word *rakau* (honestly) in *hayu*, *ai*, *ei*, *kayu*, *diwal*, *pasil*, *ie*, etc., as Mr. Codrington says, we shall require "more light" than a single book can afford us. There can be little reason for studying Maori through such corrupt and degraded channels as the Melanesian speech; it would be about as reasonable as to study the English language through the "slave-blobber" of the American Negro. It seems to me that Mr. Codrington's efforts are used to make those among whom he labours be considered equal to any of the other islanders. He says (p. 12): "The Melanesian people have the misfortune to be black, to be much darker, at least, than either Malays or Polynesians;" (at p. 18) "there is no doubt a certain reluctance on the brown side to acknowledge the kindred of the black. The Melanesians are the poor relations, at the best, of their more civilized and stronger neighbours;" (at p. 85) "to the Polynesian, who is shocked at being claimed as a relation by a much blacker man than himself, it is answered that he speaks a language very like the Melanesian, but not so complete and full." The gist of these remarks seems to be, "My black-fellow is as good as (if not better than) your brown-fellow." I can only say that there is no more reluctance among the Polynesians to acknowledge kinship with the Melanesians than there is among Europeans to acknowledge kinship with the light races of the South Seas. By the accounts of the early explorers, they again and again mistook Polynesians for Europeans. Ethnologically, I should think that the distance between the straight-haired, light-brown, Polynesian and the blue-black, woolly-haired Melanesian was very great, in type, although there may be many intermediate links in the islands, made by persistent "crossings" of the strains of blood.

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* Mr. Atkinson's example of *mauri* meaning "living" is the "God save you" expression, used when one sneezes: *Tihe, mauri ora!* ("Sneeze, living soul!") Only, unfortunately for Mr. Atkinson, the word for "living" in this sentence is *ora*, so that as an example of *mauri* meaning "living" it is very weak.

The Malagasy speech-family is a very difficult subject to treat of: as to many words being kindred (*if the sound and sense resemblance is acknowledged as proof of unity*) with the Malay, the fact is indisputable, although I believe many of the coincidences are fallacious. But the Polynesian words to be found are few indeed: the words used in Madagascar have been but too often compared with the corrupt and abraded forms of Eastern Polynesia, wherein, by the dropping of important letters, all original form of the word has been lost, and become worthless for purposes of comparison. And the grammar! He must be a "grammarian with a theory," indeed, who finds Malagasy, Papuan, Malay, and Maori grammars identical. The Malagasy is so full of words adopted from English, French, Portuguese, Arabs, and the neighbouring African tribes (as well as Malays), that comparison is infinitely dangerous and difficult.

Mr. Atkinson made a very long quotation from Professor Whitney's "Life and Growth of Language," with the object of overwhelming me by an authoritative statement as to the only manner in which etymologies of differing languages may be compared. The main point in the quotation is, that "whereas a close verbal resemblance between the nearly-related tongues has the balance of probabilities in its favour, one between only distantly-related tongues, or those regarded as unrelated, has the probabilities against it." Who, then, are to be the judges as to the languages to be considered related or unrelated, *before they have been compared?* For centuries the classical languages of Europe and the classical language of Hindustan were supposed to be unrelated, and it is only in our own generation that the claim, fiercely contested, of the Celtic-speaking peoples to be admitted into the Aryan family was acknowledged. Plenty of sarcasm and ridicule (now forgotten), plenty of loud, frothy denial was poured upon the advocates of the Aryo-Celtic theory. To use the name of Professor Whitney is to charm with the wand of one whose name is respected by every educated Englishman, and a two-fold measure of this respect is due from those who are students of language; but can anyone believe that Professor Whitney advocates the method followed in European linguistics being applied to the study of Polynesian? That is to say: *that the literary and historic method should be applied to the study of races having no literature and no historical records?* An idea so brilliant cannot be Professor Whitney's—it was reserved for an Antipodean writer to evolve this spasm of genius. Must we be contented never to compare the Polynesian language with any other until we obtain their literary records? I decline to do this, and I will quote the words of one greater than Professor Whitney concerning this question. Professor Max Müller, in his "Introduction to the Science of Religion," p. 97, says:—

"My chief object in publishing, more than twenty years ago, my letter to Bunsen 'On the Turanian Languages,' in which these views were first put forward, was to counteract the dangerous dogmatic scepticism which at that time threatened to stop all freedom of research, and all progress in the Science of Language. No method was then considered legitimate for a comparative analysis of languages except that which was, no doubt, the only legitimate method in treating, for instance, the Romance languages, but was not, therefore, the only possible method for a scientific treatment of all other languages. No proofs of relationship were then admitted even for languages outside the pale of the Aryan and Semitic families, except those which had been found applicable for establishing the relationship between the various members of these two great families of speech. My object was to show that, during an earlier phase in the development of language, no such proofs ought ever to be demanded, because, from the nature of the case, they could not exist, while yet their absence would in no way justify us in denying the possibility of a more distant relationship."

It is precisely this point I wish to establish: my contention being that Polynesian is "Aryan in the agglutinative stage"—the more valuable because in the agglutinative stage language is comparatively "transparent," and therefore etymologies are knowable; while in the later inflected stage (when the inflections consist of dead and forgotten agglutinations, as in case-endings) the primitive sense can only be guessed at and quarrelled over. From European philologists we hear what they infer the pre-inflectional Aryan language must have been, when "the flections had not yet been evolved, and when the relations of grammar were expressed by the close amalgamation of flectionless stems in a single sentence-word;" when "there was as yet no distinction between noun and verb," and "the accusative and genitive relations of after-days did not exist;" "when as yet an Aryan verb did not exist, when, in fact, the primitive Aryan conception of the sentence was much the same as that of the modern Dyak;" when, "apart from the imperative, the verb of the undivided Aryan community possessed no other tenses and moods;" when "the parent-Aryan was once itself without any signs of gender." It is to the Aryan tongue in its crude but more vital childhood that I wish to compare the Maori language.* If there was the slightest historical probability that the Maoris had received the words which compare in sound and sense with European and Asiatic ones, either by conquest, by commercial intercourse, or by religious teaching, then those words would be easily separable: as easily as the later Sanscrit can be detected in those words of Malay introduced by Brahmin and Buddhist priests from India. It is not possible even to pretend the probability of such late intercourse between Asia and the Maori: the Maori tongue gives evidence of being a primitive form of speech, not a decayed dialect of a nobler language. It is only through negligence, or want of acquaintance with the Polynesian tongues, that the most remarkable of these "coincidences" have not been investigated before. Such men as Bopp and Humboldt (both of whom saw the sure affinity) failed from sheer want of material. To rely upon such information as the Tongan of Mariner, and the Maori of Lee and

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* See Fornander, "Polynesian Race," vol. iii. p. 12.

Nicholas, was to possess a most unfortunate basis whereon to erect any kind of superstructure. As an example of later incapacity in regard to Polynesian, I may quote from Maxwell's valuable "Manual of the Malay Language" (p. 10): "A long list might be made of common words not included in any of the following groups, which are almost pure Sanscrit, such as *bawa*, 'to bring,'" etc. Now, here we have a Malay word, *bawa*, which, if allied to the Sancrit root *vah*, "to carry," is certainly not so near as the Polynesian *waha*, "to carry." Yet in the same work (p. 8) is given a quotation from Crawford's "Malay Grammar," in which the writer says: "An approximation to the proportions of Sanscrit existing in some of the principal languages will show that the amount constantly diminishes as we recede from Java and Sumatra, until all vestiges of it disappear in the dialects of Polynesia." The writer must have known more about Malayan than Polynesian.

Concerning those Semitic languages which Mr. Atkinson brings forward as evidence how my method can be applied to them, he at once frankly confesses that his knowledge of Arabic is of such a quality that he has not even taken the trouble to acquire the ability to read the written character. I have a greater charge to bring against him even than indolence: he does not seem to have understood the A, B, C of modern philology, which separates the root-formation of the Aryan and Semitic branches of language into two distinct systems: "The root of Aryan verbs is all but invariably monosyllabic, consisting of a consonant followed by a vowel, as in *da*, 'give,' or *sta*, 'stand:' but the root of the Semitic verb is always trilateral, or rather triconsonantic, and therefore necessarily dissyllabic—*i.e.*, instead of being, as in Aryan, an open syllable, it is always close (as in *qtl*, 'to kill;' *dbr*, 'to speak;' *ktb*, 'to write.') . . . Thus, in Greek, *γράμμα* is 'a writing,' *γραφεύς*, 'a writer,' and *ἔγραψε*, 'he wrote;' whereas in Hebrew SePHeR is 'a book,' SoPHeeR is 'a writer,' and SâPHaR, 'he wrote.' Again, in Greek, *βασιλεὺς* is 'a king,' and *ἐβασίλευσε*, 'he reigned;' but in Hebrew MeLeK is 'a king,' and the same word with other vowels, MâLaK, 'he reigned.' Thus it is as if in Hebrew the trilateral consonants—which were the only things which appeared in writing at all, the vowels being left absolutely unrepresented—were things too sacred to touch."*

My contention is that the Maori language is founded on the Aryan, and not on the Semitic root-system of trilateral consonants; that Maori is formed, fundamentally, on open syllables of a consonant followed by a vowel, as Farrar and Max Müller both state that the Aryan languages are formed. If Klaproth's theory of a primitive universal language can ever be proved true; if it should hereafter be demonstrated that in spite of the divergencies of Aryan and Semitic, caused by ages of inflectional corruption, yet these families are in origin one, then it will remain as an undisputed fact that the Aryan and the Polynesian dwelt together, partaking of the same word-growth, centuries and ages before they branched apart on the tree of language. I am glad that Canon Farrar used the Hebrew, *melek* "a king," as one of his examples, for the kindred Arabic, *malik*, is placed by Mr. Atkinson as a comparative for the Maori *ariki*, "a noble," "a chief." I had already given the Gaelic *ardrigh*, "a high king;" Greek *arche*,[*] "chief;" and *archon*, "a chief magistrate," as being connected at base with *ariki*. I now give one or two more comparatives. O'Reilly ("Irish Dictionary") says, *arigh* "chiefs;" while Pictet[†] gives, Irish *aireach*, "chief;" and Sanscrit *aryaka*, "venerable man." These I believe to be on the roots *ar*, or *ark* (Sanscrit *rik*) as "noble;" and I cannot at present see that they are connected with the **MLK** root of *malik*, which Farrar analyzed above. An interesting quotation from Grimm[‡] establishes the fact of the word being similarly used in ancient Scandinavia: "It had been the custom from of old for a new king, on assuming the government, to travel the great highway across the country, confirming the people in their privileges (R.A., p. 287, 8). This is called in the old Swedish laws '*Eriksgata ridha*,' 'riding Eric's road.' Sweden numbers a host of kings named *Erik* (old Norse *Eirikr*), but they are all quite historical, and to none of them can be traced this custom of the *Eriksgata*. With the royal name of Eric the Swedes must have associated the idea of a god or deified king: the 'Vita Anskarii,' written by his pupil Rimbert, has a remarkable passage on it. When the adoption of Christianity was proposed to King Olaf, about 860, a man of heathen sentiments alleged '*Se in conventu deorum*, qui ipsam terram possidere credebantur et ab eis missum, ut haec regi et populis nunciaret. . . . Porro, si etiam plures deos habere desideratis, et nos vobis non sufficimus, *Ericum*, quondam regem vestrum nos unanimes *in collegium nostrum asciscimus*, ut sit *unus de numero deorum*.'" A Maori would have said: "As *Ariki* in the College of *Wharekura*"—it should be remembered that *ariki* was "priest" as well as "lord." I still believe that (as stated in the "Aryan Maori,") the Sanscrit *rishi*, "priest, sage, holy one," is connected with this word, and that *ardrigh*, *arigh*, *eric*, etc., are compounds, as *ariki* is. On the Polynesian side I may instance the Mangaiian form

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* Canon Farrar, "Language and Languages," pp. 354-56.

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[*] In a previous paper I have written "*arke*" for *arche*. The kappa sound must have been the most primitive (√ARK).

[†] "Les Origines Indo-Européenes," vol. iii., p. 163.

[‡] "German Mythology," p. 860.

ngariki, "the (lands of the) kings" (*nga-riki*); the Hawaiian *lii*, "a chief, a king, a ruler," said by Lorrin Andrews to be the primary form for *alii* (*ariki*); the Mangarevan *akarîki*, "king, lord," where *aka* stands for Maori *whaka*, the causative, and *riki* = *rex*, *righ*, *ric*, etc., the European form of "king" or "lord."*

I will now briefly notice the part of Mr. Atkinson's paper wherein his humour expends itself most direfully: that which treats of the "cock and bull," and the *naga* or "serpent." The "cock and bull" is based upon a play on the word *kakapo*; a word which, it is true, I did not mention, but that is a small matter. The *kakapo* is a species of parrot, and Mr. Atkinson decides that the etymology of the word means "night parrot," on account of its nocturnal habits. This seems highly probable, and I do not attempt to dispute the etymology, which, probable or not, no one can now absolutely decide,† and it is as good as many other guesses at Maori etymologies. There would be nothing ludicrous in the connection of *kaka* with "cock;" words similar to this, and evidently onomatopoetic, mere names derived from sound, have been used for many birds all over the world. The Maoris now call the cock *tikaokao* (*ti-kao-kao*), evidently a sound-word, from its cry—*kaka*, the parrot, being also probably named in the same manner. This is fully recognised in the Fijian proverb, which says wisely and wittily, "A boaster is like a *kaka* (parrot), always shouting out his own name." The Greek word κόκκυ, "the cry of the cuckoo;" our own word "cuckoo" itself; our word "cock" (from Low Latin, *coccum*); the Sanscrit *kaka*, "a crow;" *kaka-pushta*, "the Indian cuckoo;" *kaka-bhiru*, "an owl," etc., all distinctly point to this word being a sound-name. In my paper on "The Maori in Asia," the word I compared with the Maori *kaka* was *kakatua*, "the cockatoo, the crested parrot." Of this word "cockatoo," Skeat says that it is Malay (it is written in Hindustani in the "Hindustani Dictionary"—perhaps adopted), and adds that, "it is, doubtless, imitative, like our '*cock*.' This Malay word is given at p. 84 of Pijnappel's 'Malay-Dutch Dictionary;' he also gives the imitative words *kakak*, 'the cackling of hens,' p. 75; and *kukuk*, 'the crowing of a cock,' p. 94; so also *kakatua*, 'a bird of the parrot kind,' (Marsden's 'Malay Dictionary,' p. 261); *cf.* Sanscrit, *kukuta*, 'a cock,' so named from its cry." So far, Skeat, who is doubtless right in comparing the name for *parrot* with the name for *cock*; but if I do the same, I, being a new writer, am regarded as food for the funny men of criticism.

In regard to the second part of the word (*po*, of *kakapo*), and that it may have had connection with "bull," I only say that

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* And in Marquesan, where *hakaiki* = "king, chief," *haka* is *whaka*, and *iki* (dropped *r*) = *riki*.

† *Kapo*, "to snatch, seize," though unlikely, may have to be considered.

Mr. Atkinson makes this assertion, (satirically, of course,) not I, because I know, as everybody does, that the modern Maori meaning of *po* is "night," and "Hades." But that a bird should be named after a bull is not without precedent, the English bird, the bittern (*Botaurus stellaris*), being named *doubly* after the bull—the derivation of bittern being supposed to be from *bos* and *taurus*—perhaps from its booming, bellowing cry; but it seems almost as ridiculous, at first, to associate together the idea of a bull and a wading-bird as a bull and a parrot. In this paper I will not enter into the question of the Maori having been acquainted with cattle, because I hope next session to deal with the subject exhaustively, on account of information gathered from all parts of Polynesia and from ancient writings; but I will in a few words put the argument into such a shape as will deprive it of any idea of improbability. If the Maoris migrated to Polynesia, they probably came from one of the great continents. If Mr. Atkinson and his party reject the evidence of tradition, and its universal consensus in the South Seas as to the migration hitherwards, I have no more to say. But, if they came from some other place, where was that place in which they had no knowledge of cattle? In Europe, the haunt of the aurochs and urus? In Asia, the home of the pastoral tribes and cattle-tending nomads? In Africa, the dwelling of the buffalo? or in America, the land of the bison? With the single exception of the island-continent of Australia, (a place there is no tittle of evidence to show that they visited,) wherever the Maoris came from, they must have known cattle. From the most eastern extremity of Asia, where the Chinese call the cow *ngau*, (*k* *ng*, *kau* *ngau*; and I compared the English *gnaw* with the Maori *ngau*, "to bite," the idea being "ruminant," "cud-chewing,") right through all changes acknowledged by philologists—*kau*, *coo*, *go*, *gau*, *bos*, *βους*, etc.,—to the extreme west, in Ireland, where the word is *bo*, the name stretches right across Europe and Asia. If the Maoris came from either of these two great continents, and knew cattle at all, it was probably by one of these two forms of the word "*bo*" (Tongan *bo*, Maori *po*) or "*kau*" that the animals were called. Thus I, who believe that the Maori race had its cradle on the lofty plateaux of Central Asia, cannot see anything ludicrous in the idea that their language retains some trace of words which they must have used, if they used any.

The "*naga*" theory I shall not defend at any length, but I decline to accept Mr. Atkinson's play upon *nga* as conclusive in any way. The Maori, who knows not the snake in New Zealand, uses for "snail, slug," etc., the word *ngata*, which in Polynesia means the "snake," and is in Hawaiian *naka*. Whether the Hawaiian form is nearest of kindred to the *naga* serpent of Sanscrit, the *naga*, Malay, "a dragon," *snaca*, Anglo-

Saxon, and the Icelandic *snakr*, I do not know; but Hawaiian forms are nearer to European in many words than Maori forms are—perhaps because, as I said in "The Aryan Maori," the Hawaiian *may be* a later migation. It is curious, too, to notice that "snail" (Maori *ngata*,) is (*snægl*) from the same root as "snake," whilst "adder" (properly a "nadder") is the German *natter*. I had spoken in "The Aryan Maori" of the "footed serpent," the lizard, being regarded with awe; it is certain that *nga* in Polynesia was used for the "lizard." The Marquesans call the large house-lizard *nga-nga*, a curious word if it is merely the duplicated article. Constantly, in Marquesan, *ng* changes with *k*, (as it does in Maori—and in Latin,)[*] the representative of this word in New Zealand being *kakariki*, the green lizard, for *ngangu*. *ngaku*, or *ngata-riki*.[†] Thus it seems highly probable that the important part of the word *ngata*, "a snake," is *nga*. If it was really the case that the Maoris, like other Polynesians, knew the snake as *ngatu*, *nata*, or *naka*, then the missionaries in giving them the word *naka* for "snake" were unintentionally (even pathetically) giving them back their own word lost for centuries, as I feel certain they unsuspectingly did in a hundred other cases, where words supposed to be *pakeha-maori*, or corrupted English, may be found in songs and incantations ages old. Be that as it may, anyone who considers that where *nga* is used in composition as a prefix it is but the plural article "the," can scarcely have examined the subject at all. Setting aside the direct words *nga*, "to breathe," *ngaunga*, "a stone," etc., there are many words prefixed with *nga*, in which *nga* evidently has some direct bearing on the sense of the word that no conception of it as merely a prefixed article agglutinated will explain. Whether *nga* has ever meant *naga* or not, it seems possible, from the genius of the Polynesian language making a vowel follow a *simple* consonant, that this double consonant sound *ng* may once have had a vowel between *n* and *g* = *na-ga*.

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[*] Marquesan, *ikoa*, for *ingoa*; *hoki*, for *hongi*, etc Latin, *pingo* and *pictum*, *tango* and *tactum*.

[†] See "Aryan Maori," p. 26.

ART. XLVIII.—*On Maori Ancestry.*

By JAMES COUTTS CRAWFORD, F.G.S.

[*Read before the Wellington Philosophical Society, 5th October*, 1887.]

IN the last volume of the "Transactions" of the Institute there are several valuable papers upon the subject of "The Whence of the Maori;" but I think they dwell too much upon the argument from language, and almost entirely omit any reference to physical characteristics. Now, if there is anything more remarkable than another in the history of the human race it is the persistence of types. If we look at the ancient sculptures of Egypt, and observe the present inhabitants, we find that the ancient Egyptian is still represented by the Copt of to-day; and the Negro of Africa presents the same type that he did many thousands of years ago. The Jew of to-day has the same form and features as his ancestors of the sojourn in Egypt. The dress is different, but the type is the same. If we consult the form and features of the old statues of Greece and Rome, or the frescoes of Pompeii, or the monuments in the cathedrals and churches of Western and Central Europe, we find the type is similar to that of European peoples of the present day. We do not find the brown or the black races represented. The Aryan type is prominent throughout.

Carried into more detail, we find varieties among the Aryans, and various crosses of these varieties, which are clearly distinguishable. Thus, in the British Isles, which contain a very mixed population, it is easy to make out the districts which are chiefly inhabited by descendants of Anglo-Saxons, or of Jutes, or of Scandinavians, or of Celtic races, whether or not the language has been retained; and it is said that in the south-west of Ireland there are evidences in form and feature of Turanian origin. Crossing the Channel to France, it is easy to see where the original Celtic race of ancient Gaul is predominant, and where it has been mixed with Norman or Teutonic blood. The difference in size and character is evident. But all the nation, with the trifling exceptions of the people of Brittany, and perhaps some Basques in the Pyrenees, speak French, and that being a Romance language, the French say that they belong to the Latin race, which, if taken to mean that they are Romans, is an absurdity. By the argument from language they may be held to be Romans, but as a matter of fact they are not Romans. Granted that the Romans may have founded cities, and sent some colonists to Gaul, so did the Phœnicians and the Greeks.

I could go on with similar remarks upon Italy, Greece, and other countries. In Italy the whole nation speaks Italian; but physically and mentally there is great difference between the

Gothic Lombard and the Greek Neapolitan. Greece has retained its old language with very little change ; but the population must have been much modified by importation of Albanians, a Sclavonic people. Malta is peculiar. In Valetta, Italian is spoken, but outside the capital the language is, I understand, Phœnician, a tongue which I do not understand. It gives one the idea of being like Arabic, but I suppose it to be older than that language as now spoken. A pure-blood Maltese has a peculiar form and features. He is not like an Italian, nor is he like an Egyptian. The argument from language may connect him with Tyre, or with Carthage, and possibly this descent may be in the main the true one.

In Russia we find people as fair and as intelligent as German, and others as swarthy as Tartars, which they are. Both speak the Russian language; but the former are Aryans, which the latter are not.

Let us see where the argument from language may lead us: A passenger, without previous knowledge of European history, arrives at Jamaica, and asks who the inhabitants are. He is told they are English, and he finds that they speak English, and are proud to call themselves "Englishmen." They tell him how their countrymen, Lord Nelson, Duncan, Howe, and Jervis, "licked" the French and the Dutch, and, though caring most for naval victories, still admire the Duke of Wellington, and brag of what "we" did at Waterloo. Nevertheless, these dark-skinned Englishmen are not Aryans—the language gives them neither the form and features nor the mental qualities. Instances of a similar kind might be multiplied, but the above will suffice.

Now, I will proceed to take a further view of the question of descent. Colour is generally looked upon as a matter of climate, but I think that is a theory which will not bear inspection. There may be said to be three well-defined colours in the human race, viz.: the white, the black, and the brown, the latter including the red and the so-called yellow.

The white man resident in the tropics may become much burnt by the sun; but his progeny is no darker than that of other people. Against this may be put the fact that many of the Aryans of India are very dark ; but this has perhaps been mainly caused by intermarriage with Turanian races. The Parsees and the high-caste natives of India are dark, but they are not black ; although the Indian Portuguese, from constant intermarriage with black races, are now very black. The negro seems very persistent in colour. He is as black, after many generations in the temperate regions of America, as when his ancestors left the shores of Africa, and his mental characteristics are similar. The brown races seem also to be persistent in character. China extends from tropical to almost arctic regions.

The Chinaman is brown in colour throughout. He does not get black in the tropics, nor white in the cold latitudes. The Eskimo, inhabiting the Polar regions, is dark. America extends from North Polar regions to Cape Horn; the aboriginal inhabitants are all of the brown type. As in China, they do not get black in the tropics nor white in the colder regions. The Maori race extends from Hawaii to New Zealand, some 6,000 miles. The colour is similar throughout, unless when a cross with the Papuans can be detected. "The Whence of the American races" is as difficult a problem as that of "The Whence of the Maori."

I do not believe that the Maoris are Aryans, because in physical appearance they are unlike any tribe of Aryans whose acquaintance I have made. I do not claim that the Maoris are inferior in appearance, but they are different. The Maori is brown in colour of skin; he has blue-black hair; his nose and lips are more fully curved than those of an Aryan, and, therefore, in some respects more handsome; his limbs are more fleshy, and his cranium seems peculiar. One may sometimes be startled by a peculiarly fine specimen of the race showing what may be Aryan characteristics, but these are exceptions.

Now, whom do the Maoris resemble?

(1.) Some of them are not unlike Chinese, but they differ enormously in character from that industrious people, and the Maoris knew none of the arts which have so long been cultivated in China.

(2.) I have seen Maori women very like what I remember of the Indians at Talcahuano, in Chile, and what struck me was that these were very like seals, both in the fat cheek and the expression of the eye. This is, however, an inferior type of Maori woman.

(3.) The Ceylonese or Cingalese is not unlike the Maori; his colour is similar, but he is much smaller. There were two Ceylonese boys on the Whanganui River who might well have passed for Maori girls.

(4.) What shall we say to the Egyptians? I believe a Coptic people, crossing by intermarriage with another race, might have originated the Maori race.

(5.) The Dravidians of India, mentioned by Thomson, I have never seen, and therefore cannot found an opinion upon my own observation. I would suggest that the ancestry lies between them and the Egyptians. Either supposition would allow reasonable data for the settlement of Madagascar by the Maori race, as well as the Eastern Pacific.

We have, however, not got beyond the region of speculation, and everything yet remains to be proved. I would suggest that the first step to be taken is the same as that adopted by Prince Roland Bonaparte—viz., to have a collection of photographs made of the various brown races. With these collected before us, we might be in a position to prosecute further inquiries in the matter of language and tradition.

It must surely have been at a very remote period that the Maoris broke away from their original home in Asia, or elsewhere, for they do not appear to have even learnt the almost universal art of pottery, were unacquainted with the use of metals, and of building in stone.

The question also should be worked out whether or not the Maori race had any connection with America, North or South. Some names of places, such as Amecameca in Mexico, seem to suggest a Polynesian origin, although the generality do not, and we find the old names in those countries much replaced from the Saints' Calendar, with a multitude of names such as San Paolo, San Luis Obispo, San José, etc., etc. From what I remember of the Indians of South America, I should say that the Peruvians differed much from the Maoris, being short in stature, demure, and sulky in character, but that possibly the Indians in the south of Chile had some resemblance to them.

I have not seen enough on the Mexican side to be able to offer an opinion, but I am told that many of the customs of Samoa are of Mexican origin; it strikes me that communication between Peru and Samoa would be much easier than between Mexico and Samoa. In the former case the navigator would have a "soldier's wind;" in the latter he would have to cross the line, get through the calms, and contend against the north-east trade winds.

I have observed that some American carvings very much resemble those of the Maoris, and a careful study of the patterns of carvings in wood might bring strong evidence to bear on the question of descent. Pictures of carvings on Burmese figure-heads, etc., should be examined.

I have not hitherto alluded to the old theory of the Malay origin of the Maoris, although Wallace considers them to be a cross between the Malay and the Papuan. I do not think this theory is satisfactory; probably the Maori is a more ancient people than the Malay. He is a more powerful animal, much more lively, seldom has straight hair, but has one quality which is present in the Malay and other Eastern peoples, but often absent from the European, viz., a dignified politeness.

One must not confound the spread of the Maori throughout the Eastern Pacific, from Hawaii to New Zealand, with the original migration of the race from some other country. It is not likely that the whole of the Pacific islands, now occupied by this people, were settled simultaneously. Possibly the first colonists arrived in Hawaii, or in Samoa or Tonga, and spread from one centre; and there is no reason to suppose that New Zealand has been inhabited by the Maoris for a longer period than their own traditions allow—viz., some 600 years. Until I had visited Fiji, Tonga, and Samoa, I had felt a difficulty in seeing how the Maoris had navigated the Pacific with the means at their command; but after seeing the numerous groups of islands, and scattered detached islands, I at once perceived that, although hazardous, in even large canoes, the exploit was not very difficult. It required skill, courage, and obstinate resolution. I suppose that some of the Pacific groups of islands may have been colonised for many centuries before the others, and that the pressure of increasing population, or intestine troubles, caused portions of the people to seek from time to time fresh homes.

The more interesting questions are: How, when, and whence the Maori found his way to the Pacific? Where was his original home, and when did he leave it? I think the tentative attempts to prove part of the above from the evidence of language are highly praiseworthy; but I doubt if they have been successful. I now suggest that the focus should be turned upon the physical and mental characteristics which may be found to connect the Maoris with races in other parts of the world; that particular attention should also be directed to the patterns of ancient carvings in wood; and that language may be also brought in as an accessory. I do not attempt to solve the question, for it might require the application of a long life, and should be undertaken by a man who combines the technical education of a comparative anatomist with the feeling of an artist, and facility as a linguist.

Art. XLIX.—*Ancient Tide-lore, and Tales of the Sea, from the two Ends of the World.*

By W. Colenso, F.R.S., F.L.S., etc.

[Read before the Hawke's Bay Philosophical Institute, 15th August, 1887.]

[Abstract.]

I had been lately reading some of the curious theories respecting the tides of the sea that were anciently held or advanced by the wisest and most civilized nations, or the philosophers of Greece and Rome; also some far more strange and peculiar notions held by Western Europe, and by Oriental races in more modern times, which, possibly, in a measure are still by them maintained: and this naturally brought me to a reconsideration of what the Maoris believed to be the origin and cause of the tides, which, being curious, and not wholly unlike what has been anciently upheld in other parts of the world, has induced me to write a paper on it. * * *

The New Zealanders believed that the ebbing and flowing of the sea was occasioned by a huge ocean monster, whose home was low down in the depths beyond the horizon, through its powerful and regular respiration, or ingurgitation and regurgitation of the water. Far-off foreign lands were considered to be lying beyond it. This monster's name was *Parata;* which term is commonly used figuratively and proverbially for any one unexpectedly meeting with great trouble—that such a person has fallen into the throat of the *Parata.* Indeed, in one of their ancient and prized myths, which treats in popular language of their first peopling New Zealand, one of their chief canoes, named the "Arawa," is said to have really got into that difficulty, and was carried into the enormous mouth of the monster, from which fearful maelstroom it was with difficulty extricated by Ngatoroirangi, the courageous and cunning *tohunga* (= priest, or wise man) on board, who recited his powerful charm for that purpose, which proved effectual; the words of the said charm or spell being also preserved.[*]

Not unfrequently in former years (since the New Zealanders had learned to write) a laconic epistle, etched with a nail or fragment of shell on a fresh flax leaf, would be despatched from those in sudden private or local trouble to their relatives or friends, couched in these words: "Friends, listen! we have fallen into the throat of the *Parata.*" and that, like the fiery cross of the far north, would often be sufficient to secure their prompt and hearty assistance.

As might naturally enough be supposed among a superstitious people, abounding in charms and spells, witchcraft and incantations, the aid, real or imaginary, of such a powerful living being, whose irresistible and regular action was daily seen, was sure to be malevolently sought against their enemies: so one of their solemn maledictory spells begins thus:—

"Dreadful, big, beetling precipices, deep down in Ocean's depths, listen! obey! be quick and be scattered far off to the right and to the left,[†] that the mighty *Parata* may go to work. *Parata!* hear! blow thy irresistible overwhelming tides strongly to the shore!"

This was done in order that the sea-side forts and villages (always close to the beach, and sometimes built on it) might be inundated, and so easily overcome, and the inhabitants scattered and, with their canoes, destroyed.

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[*] Grey's "Mythology," p. 72.

[†] *Lit.,* "to the one side and to the other side;" "*ki tetahi taha, ki tetahi taha.*"

Of course, we of to-day are a step in advance of our own forefathers in this matter; *we* can well afford to laugh at the power of such a charm or spell, based on such a belief; nevertheless the New Zealanders believed in it, and we may easily imagine that if, after solemnly uttering their spells by the priests at their pagan altars, and with all due and fearful invocations and ceremonies, a storm came on from the sea, or a high tide followed, such would be laid hold of as a favourable omen, and be sure to inspire them with extra courage in their fiendish work of destruction and slaughter! Besides, among a race like the Maori—keen and constant observers as they ever were of the appearances of the heavens and of the varied phenomena of Nature; who had proper significant names even for every day of the moon's age, with their lucky and unlucky days, as well as for the different stages and seasons of the tides; who knew all about times of flood and ebb, of high and of low water, spring and neap tides, with their numerous intermediate variations—it is likely that their *tohunga*, who had to utter the said powerful charm, would avail himself of his knowledge of the time of the spring tides to make it appear to be the more effectual.

I scarcely need remark that such spells and invocations were not confined to the New Zealanders, or to uncivilized people like them. Plenty of such doings will be found among the records of the oldest and most civilized nations of antiquity.

* * * *

Formerly, and down to some years ago, the winding-track or course from Napier into the interior to Te Aute and Waipawa lay by the immediate bank of the River Ngaruroro; and one of the ugly and often dangerous places which had to be crossed at its mouth was a brawling, noisy watercourse, or fall, on the east bank, which drained the big marsh on the plains. This waterfall was called by the Maoris *Wahaparata* = Parata's Mouth, from the noise it made, from the ever-varying amount of water it discharged, and from it being disagreeable and dangerous; besides, as I have heard old Maoris say, it was affected by the high tides on the coast; and in this respect they may have been correct, as the sea is not far distant in a direct line, and the River Ngaruroro (and also the River Tukituki, which bounds the said marsh on its east side) is but a short distance from it, and both rivers are greatly influenced by the tide for several miles from their (one) mouth. Pliny relates instances of wells in cities near the sea being largely affected by the tides in his time. (*loc. cit.*, book ii., chap. 100.) Many an early settler has come to grief in crossing that place—*Wahaparata!* I, myself, more than once, among the number; some having had to swim for it, themselves and their horses, when the water in the River Ngaruroro was high.

Here I may briefly state that this word or name of *Parata* was also of great and ancient usage among the Maoris. The first time we hear of it was as the name of a principal chief, before the legendary period of their so-called migration hither to New Zealand; for thus it is stated in their legends :—

"Soon they fought; shortly after, peace was made; then they felled (the tree to build) the canoe 'Arawa,' this was done by *Parata*, by Wahieroa, by Ngahue."*

In the old myth of Maui transforming his brother-in-law Irawaru into a dog, and the widow, his sister (Hinauri), becoming distracted over the loss of her husband, she goes off to the rocky cliffs at the seaside to commit suicide, and there utters her mournful dying dirge, beginning thus :—

"Ever lamenting !—
Henceforth I (am) ever imploring
To the stealthy-one† of the ocean,
To the big *Parata* of the ocean,
To the huge monster of the ocean,
To the enormous whale‡ of the ocean,
That (he) may come hither
That Hina may be swallowed up."

So saying, she threw herself into the sea.

The word is also found in the ancient prayer or semi-incantation used by the *tohunga* at their old cannibal orgies, when initiating the young men and boys (chiefs' sons), in order to their partaking of the flesh of their enemies slain in battle. Thus it begins :—

"This youth present gnaws,
This youth present strives,
This youth present eats,
This youth present eats man's flesh,
This youth present swallows *parata*."

which may mean "lords (of foes)," or "monsters," or "great difficulties and dangers," (or all together,) overcoming them as easily as "swallowing one's spittle" (a common Maori metaphor). The said long prayer or spell concludes thus :—

"This youth shall soon eat,
This youth shall soon swallow man,
Shall eat to-day,
Shall eat to-morrow (hereafter),
Sufficient now (for the first time) this youth shall eat."

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* Grey's "Poetry of the New Zealanders;" *Korero-Apiti*, p. viii

† Or, steep precipices in ocean's depths.

‡ Lit. *Paikea*, a large species of whale with a white belly, deeply grooved longitudinally; one was stranded on the beach near Napier about 1847; also a Maori name for a long house with the doorway in the end. (See *Note*, "Trans. N.Z. Inst.," vol. xiv., p. 20.)

Parata is also the name of that part of a war-canoe that projects out at the bow, beneath the image or figure-head, and meets the rising waves; near this was the coveted seat or stand of the hero or warrior chief. Thus, the old song:—

> "To stand firmly at the bow of the canoe (is to be) renowned."

The term is also commonly used in their mournful poetical laments and dirges over their dead chiefs, in these (or similar) words:—

> "The eddy-squall is over; the storm is passed away;
> The *Parata* is gone; the big fish has left its habitation."

ART. LI.—*Notes on the Derelict Ship in Facile Harbour, Dusky Bay.*

By T. M. HOCKEN, M.R.C.S., F.L.S.

[*Read before the Otago Institute, 14th June, 1887.*]

Plate XXI.

RECENTLY discovered though New Zealand is, the frosts of time have already commenced the graving of her antiquities, and to almost the oldest of these I beg to draw your attention for a few minutes this evening. The last remnants of an old wrecked vessel are still to be seen, at favourable times, lying in Facile Harbour, Dusky Bay. Numerous and various have been the conjectures as to the how, whence, and where of this ocean waif, which, if my conclusions are correct, has been resting in its grave for near upon a hundred years. In the endeavour to unravel the riddle, which, sphinx-like, this old vessel propounds, I venture to lay before the Institute a few notes, the result of inquiries from many trustworthy people, and of yet further research. The last discussion with which I am acquainted appeared in some of the December numbers of the "Southland Times" for 1882, under the striking heading, "The *Madagascar* Mystery." From this it appears that the *Madagascar* was a ship bound from Sydney to England 36 years ago, in the good old days of early New South Wales and Victorian diggings, and that she carried a valuable freight of gold. Nothing was ever heard of her. Notwithstanding this, it is stated that the discontented crew mutinied, overpowered the captain and officers, ran the vessel into Dusky Bay, and stole and buried the boxes of gold, marking the *cache* by driving a pickaxe deep into an adjoining tree. The crew, reduced to three by privation and exposure, managed to reach Lake Wakatipu, where they were hospitably treated by the

Maoris and enabled to leave the district, though in what direction is not said. The simple narrator goes on to add that the lucky man who finds that pickaxe will have no further cause to work for a living.

I tell this wild story not merely because it is exciting and romantic, but as showing on how trifling a foundation a conspicuous story is too often built, and how flimsy, though positive, may be the information vouchsafed to curious inquirers after something buried in mystery. Ten years ago, when on a trip to the West Coast, I first saw this mysterious vessel as our steamer passed her. Since that time I have allowed no opportunity to escape of gaining any reliable information of her. My first application was, in 1879, to Mr. William Docherty, who for so many years has avoided the haunts of men, and preferred to bury himself in the wild fastnesses of the inhospitable West Coast region whilst searching for mineral wealth. In response, Mr. Docherty, in the most obliging manner, made a special trip to the old vessel, and sent me certain articles which he found in her, and most of which are now exhibited. In the interesting letter accompanying these relics, he says: "What is left of her now is but the shreds of a wreck; yet, putting one thing and another together, one can fasten in his mind that she was once a large, well-put-together vessel. She must have been in a perilous and sinking condition when she came here, because he who had command ran her ashore on the first beach inside the harbour. I travelled through the bush to several of the headlands, thinking that I might see some traces of humanity; but everything in nature was *in situ* there." The specimens sent consist of lead and copper sheathing from off what remains of the stern, a rusted iron bolt, and, what is of more importance, pieces of bamboo cane and of stone ballast. This ballast is freestone, and under it, says Mr. Docherty, are lots of cane, which he reasonably concludes to be dunnage—that is loose material thrown into a ship's bottom to prevent injury by water to the cargo.

Captain Fairchild, of the *Hinemoa*, has most kindly given me a full account of his visit to the wreck in 1878. He says: "She is in a little nook, or pocket, so small that it was impossible for her to sail in. She must have been hauled in with ropes made fast to the trees. She is 180 feet long and about 32 feet beam. Her outside plank is 5 inches thick, all East India teak. She is sheathed with pure copper, and all the bolts used in building her are pure copper also. She is built about one-third of English oak and two-thirds teak. Her stern is in 20 feet of water and her bow in 5 feet only. She was known by the whalers to be there sixty-five years ago, and was an old ship then. In the early days the whalers used to chop her away for firewood, and they have chopped her down to the water's edge, and she only shows a little above the water at low water spring tides. She is quite clear of the ocean swell, in a perfect snug harbour, and must have been taken there on purpose to be condemned. She has freestone and chalk for ballast, and has some little bits of bamboo amongst the ballast. She is a good model, and, I think, was a fast sailer, and she must have been between 700 and 800 tons register. I got one of her rudder braces off her. It was composition, and weighed 200lbs. It had the words 'Saville, London,' on it. There are also some pieces of cast-iron amongst the ballast. Her upper deck and beams are all gone, and nearly all her 'tween deck beams have been chopped away by the whalers. The wood is quite sound, and has not been eaten by worms, as might be expected. There is a good deal of fresh water where she lays, which keeps away the sea-worms."

Captain Fairchild is very desirous of gaining the authority of the Government to raise her. He considers this could be done in a few days, and, if aided by a diver, thinks that some interesting and, perchance, valuable discovery might be made. Certainly, these are not times in which to incur any but the most unavoidable expenses. Still, there would be no harm in bringing the matter before the House, and, if the cost were trifling, of giving effect to Captain Fairchild's laudable suggestion.

When in London, five years ago, I made pertinent inquiries, but with no result. The present firm of Shaw-Savill is no continuation or offshoot of the "Saville" of our inquiry.

Mr. Ned Palmer, who died last year, and a sketch of whose eventful life will, I hope, soon appear in the "Otago Witness," began sealing on the west and south coast of New Zealand sixty-two years ago. He knew the vessel well, and had cut wood from it. He did not know her name, nor where she came from, but said that Lascars formed part of her crew, and that he well knew a Lascar who had been one of her castaways, and who was also engaged in sealing and whaling in one of the earliest gangs. Captain Stevens, who lives near Riverton—one of the last remaining, if not the last, of our ancient mariners—confirms this. He came to New Zealand forty-five years ago, and knew this Lascar, who died thirty years since, at Stewart Island, a very old man. He told Captain Stevens that the vessel sailed from New South Wales for London, and that she sprung a leak, whereupon a mutiny ensued. This scanty but important information was all I could gather from this source.

Sir James Hector also saw the wreck during his interesting exploration of the West Coast, in 1868.

I omitted to mention that in the Wellington Museum there has been lying for many years a curious case, or box, found by Captain Fairchild at the time of his visit. No one has hitherto been able to assign a use for this article. It is parallelopiped, open at one end (which is very much broken), and measures 3 feet 3 inches in height by 13 inches in breadth. Its secret remains as unsolved as that of many a monolith. My own impression is that it was used to convey bullion. One ancient mariner, long ago engaged in the Indian trade, to whom I applied for a solution, said that gunpowder, first protected by flannel bags, was encased in such boxes. But the fact of its being of iron all but positively negatives such an explanation.

Such is a statement of all the facts connected with our subject, so far as I have been able to gather them. What conclusion can be drawn from them? It seems highly probable that the conjecture offered by a correspondent in the "Australian Shipping News" of 1878 is correct—viz., that the wreck is that of the ship *Endeavour*, Captain Bampton, bound from Sydney to India, in 1795. In those early days of the convict settlement, large supplies of cattle, food, and stores were brought to it from India; and about this time an occasional return vessel would load at New Zealand, principally the Thames, with spars and masts for the use of the East India Company's service. This was the germ of an extensive trade of this sort.

The results of a good deal of research have proved so interesting, and have brought so many forgotten facts to light connected with the very early history of New Zealand, that I shall not hesitate to interweave some of them into this portion of my notes, especially as they confirm the identity of this phantom ship.

Captain Cook, on the occasion of his second voyage to New Zealand, in 1773, stayed for six weeks in Dusky Bay. His interesting description of this visit is accompanied by a remarkably accurate chart. In few places in New Zealand did he find such plentiful refreshments as here, and he recommends any vessel going southward, and needing a haven, to make for it, as with the prevailing winds it is easily entered and easily left. It is therefore certain that in those early days any storm-stressed mariner steering south would seek this only-known haven.

The whale fishery in these seas had its first origin in October, 1791, when five of the transport vessels, after discharging their convict freight, and acting upon instructions received before leaving England, commenced to whale along the coast of New South Wales. Owing to various causes, which need not be recited here, their success was not very great, although fish were seen in great numbers. It was not long before the whalers went further afield. The first to visit Dusky Bay was the *Britannia*, Captain Raven, belonging to the great shipping firm of the Messrs. Enderby. After her departure from Sydney she touched at Dusky Bay, in October, 1792, where she left the second mate (John Leith) and several of the crew for the purpose of procuring seals, the principal object of the voyage from England. She then proceeded on her way to the Cape of Good Hope, there to procure cattle and stores for the settlement. It is pretty certain that this was the beginning of the future great sealing industry of New Zealand, undertaken in the first instance by the English, and not, as is generally supposed, by the Americans. John Leith, recognising the possibility of himself and party remaining indefinitely and uncalled for in Dusky Bay, wisely employed a portion of his time in building a little schooner, wherewith to effect an escape in case of need. The necessity for this did not, however, arise. The *Britannia* again arrived at Sydney from the Cape of Good Hope in June, 1793, and was chartered to proceed to India for provisions. It was determined by the Lieutenant-Governor that the schooner *Fancy* should accompany her to Dusky Bay, and bring back full information regarding the seal fishery, spar-cutting, or anything else that might tend to the benefit of the settlement. The vessels sailed in October; and the *Fancy* returned in November, reporting that the sealing party had procured 4,500 skins. They had enjoyed excellent health, though the weather had been very bad—so bad, indeed, as often to interfere with their fishing operations—heavy rains and gales, and once a shock of earthquake. The Natives were very quiet and harmless, and, indeed, seemed rather to avoid the party. Provisions were plentiful—ducks, wood-hens, and fish. The little schooner of 65 tons was nearly completed, and was, of course, left. The accounts were not, on the whole, sufficiently encouraging to induce further attempts to develope industries in Dusky Bay.

We now come to occurrences specially connected with these notes. In May, 1795, the *Endeavour*, an 800-ton ship, Captain Bampton, arrived at Port Jackson from Bombay, with a large number of cattle and stores. This Captain Matthew Wright Bampton had made previous voyages to the settlements with cattle and provisions; and a third time he sailed for India to perform a similar contract with the Government, intending to touch at New Zealand by the way. It would seem to have been the practice in those days for two or more vessels to sail together for some distant port. On this occasion the *Fancy* accompanied the *Endeavour*. This was in September, and it was on this voyage the disaster occurred. News of it was brought from the branch convict settlement at Norfolk Island, in March, 1796, seven months afterwards. It appeared that on reaching Dusky Bay the vessel was so leaky that she was there run ashore and scuttled. Besides the crew, there were more than 100 people on board. Fifty of these were ex-convicts, whose term of sentence had expired; and the other fifty were what we term now-a-days stowaways. The little schooner which had been built, and left by the sealing party three years before, proved now a godsend. They finished it, and appropriately christened it the *Providence*. Crowded with as many people as possible, the *Providence* and *Fancy* sailed for Norfolk Island, arriving there in safety. Those left behind were to follow in a little vessel to be constructed out of the *Endeavour's* long-boat. This waif of the sea, then, which was named the *Assistance*, arrived later on at Port Jackson in a sad plight. The last mouthful of provisions had been consumed a day or two before her arrival. Indeed the scarcity of provisions had necessitated leaving several people behind at Dusky Bay, where it was presumed they would not starve on seals, fish, and native birds. For six months these unfortunates, thirty-five in number, remained in their desolate solitude, when they were released by the Captain of the American vessel *Mercury*, who landed them at Norfolk Island. There were no facilities for sending earlier assistance, and the captain of the *Mercury* stipulated with the Governor, who sought his services, that as a return he should be allowed to take from the wreck any stores he might be in want of.

Such is the conclusion of this interesting story; and I think there can now be no doubt that the enigma is satisfactorily solved, and that this derelict ship of Facile Harbour is none other than the *Endeavour*, which was bound from Port Jackson to India, and that here has she lain for the last 98 years.

These interesting particulars have been gathered chiefly from the valuable journal of Mr. Collins, first Judge-Advocate and Secretary of the colony, published in London in 1798. It is not unlikely that the publication of this account may bring forth further information relative to the very earliest visits of civilised man to New Zealand, dating from Captain Cook; and with this view I have been careful to give exact dates. At the time referred to there were no newspapers in Sydney; but it is very likely that those published in India contain many references to New Zealand.

The following note, which bears on this question, has been supplied by Captain Fairchild, being an extract from a letter from Mr. Percy Smith, Assistant-Surveyor-General for the Colony:—

"Judge's Bay, Auckland,
"March 1, 1888.

"MY DEAR CAPTAIN FAIRCHILD,—

"I have just come across a little item of the history of New Zealand which will, I think, interest you.

"'In 1808 the brig *Venus*, commanded by Mr. Bass, was at Port Jackson, and he there writes to Mr. Waterhouse at Hobart, notifying his intended voyage to the coast of South America, and speaks of his intention to go to Dusky Bay, in New Zealand, for the purpose of picking up two anchors, and taking the iron fastenings out of an old Indiaman named the *Endeavour*, that lies there deserted, with the intention of selling the former to the Spaniards.'

"Bass (who discovered Bass' Straits) sailed for Chili, and was never afterwards heard of.

"No doubt the old Indiaman is the vessel you told me of, lying at Dusky Bay.

"Yours faithfully,

"S. PERCY SMITH.'

ART. LI.—*On a Stereoscopic Aspect of the Moon.*

By J. HARDCASTLE.

[*Read before the Hawke's Bay Philosophical Institute, 15th August,* 1887]

THE full moon presents the appearance of a disc, not of a sphere, to most if not all people, and I have never met with any other description of her appearance. But, by a little ingenuity, a truly stereoscopic view of our satellite may be had. If, when the full moon is on or near the meridian the light is conceived to fall upon her from above, and to the left, the darker portions on the opposite side fall into the positions of shadings natural to a sphere so illuminated under ordinary circumstances, and the visible surface stands out boldly as a hemisphere. The photograph of the full moon in Proctor's "Moon" will give this effect, but less distinctly than the orb itself, the dark portions being too dark, perhaps. Having once seen this solid aspect of the full moon, it always presents itself, at least to me. If this is a new and not a re-discovery, and wonder is felt that it was not observed before, the obvious explanation is that the moon is upside down, so to speak, to the inhabitants of the Northern Hemisphere, where observers, till of late years, have lived; and they must lie down, or stand on their heads, to get the view of it that we have, or suppose the unusual condition of the sphere being illuminated from below.

Art. LII.—*On the Etymology of the Word* "Dierectus," *in Plautus.*

By Professor F. W. Haslam, M.A.

[*Read before the Philosophical Institute of Canterbury, 2nd June,* 1887.]

The word "*dierectus*" is used by Plautus thirteen times, and by no other Latin writer. The etymologies suggested for it are: (1.) *dis-erigo*, which would make it mean "one lifted up in two directions," *i.e.* "crucified," *i.e.* "a scoundrel." (2.) It is connected with *dies*, *i.e.* "one lifted up '*in diem*,'" *i.e.* "crucified," *i.e.* "a scoundrel." Professor Nettleship doubts its Latinity *in toto*, and thinks that it is a mistake for *derectus* or *directus*, as the case may be: *i.e.* (*derectus*) "one who is sent downwards," *i.e.* "sent to Hades," *i.e.* "a scoundrel:" or (*directus*) "one spread out in two directions," *i.e.* "crucified," *i.e.* "a scoundrel." Neither of these etymologies, (1.) and (2.), seem satisfactory. I do not think we have any similar phrase, or any really good evidence which would seem to imply that the Romans or Greeks thought of crucifixion as a process of being "lifted up" or "spread abroad," rather than anything else.

The passages in which the word occurs will, however, for the most part, fairly bear out the meaning, "one worthy to be crucified," "a scoundrel." It is, of course, unnecessary to remark that if you wish to say that a person whom you detest is worthy of punishment, it was not unusual among the ancients to express one's feelings by saying that the said person had already suffered such a punishment. *Cf.* also the use of "*invictus*" for "*invincible*," and other similar words. The practice and idiom is not unknown to modern times either. To return, however, to the passages in which *dierectus* is found: there is one, viz., "Curculio," ii., 1, 21, "*lien dierectus't*," where the word is explained by a gloss as = *diruptus*, *i.e.* "burst asunder." This suggests a clue to another etymology which gives a similar meaning, though derived from a different source. It must be remembered that the plays of Plautus were taken from Greek originals. In the comedies of Aristophanes the word διαῤῥαγέιης frequently occurs, *i.e.* "may you burst asunder," *i.e.* "curse you," "a bad end to you." Also such phrases as ὄιμοι, διαῤῥαγήσομαι, which would be a parallel to the above passage in the "Curculio." The participle διαῤῥηκτὸς would then mean "a person who has burst asunder," or "come to a bad end," *i.e.*, according to the idiom noticed above, "a scoundrel." *Dierecte* would then be equivalent to some such phrase as "ὦ διαῤῥηκτὲ σύ," "you scoundrel," and would be simply the Greek word inaccurately translated into Latin, unless we take the long Latin *e* to be a proper rendering of the Greek *α* before a double consonant. If this is possible, it would satisfy the meaning of all the passages, I think.

P.S.—Since writing the above, I find that this view was taken by Salmasius; and I see that Professor Nettleship, in the "Journal of Philology," thinks it possible that *dierectus* may be a bastard form from διαρρήγνυμι.—F.W.H.

NEW ZEALAND INSTITUTE.

NEW ZEALAND INSTITUTE.

Nineteenth Annual Report, 1886–87.

The Board held meetings on the 22nd July, 1886, and 10th February, 1887.

The members who retired from the Board in conformity with clause 6 of the Act were the Hon. Mr. Waterhouse, Mr. Mason, and the Ven. Archdeacon Stock, all of whom were re-appointed by his Excellency the Governor.

The elected members of the Board for the year are Dr. Hutchinson, Mr. J. McKerrow, and Mr. T. Kirk.

The following are the members now belonging to the Institute:—

Honorary members	29
Ordinary members—	
Auckland Institute	277
Hawke's Bay Philosophical Institute ...	139
Wellington Philosophical Society ...	248
Philosophical Institute of Canterbury ...	116
Nelson Philosophical Society	50
Westland Institute	69
Otago Institute	156
Southland Institute	72
Making a total of	1,156

The volumes of "Transactions" now in stock are:—Vol. I. (second edition), 287; Vol. V., 89; Vol. VI., 40; Vol. VII., 186; Vol. IX., 140; Vol. X., 171; Vol. XI., 52; Vol. XII., 60; Vol. XIII., 61; Vol. XIV., 82; Vol. XV., 192; Vol. XVI., 216; Vol. XVII., 246; Vol. XVIII., 190; Vol. XIX., not yet fully distributed.

Vol. XIX. of the "Transactions" was published in May last, and contains seventy-two articles; also addresses and abstracts of articles which appear in the Proceedings. It contains 680 pages of letterpress and 28 plates. The following is a comparison of the contents with that of the volume for the previous year:—

	1887. Pages.	1886. Pages.
Miscellaneous	120	72
Zoology	212	146
Botany	114	108
Chemistry	...	4
Geology	184	48
Astronomy	...	26
Proceedings	48	83
Appendix	52	51
	680	488

The cost of printing Vol. XVIII. (new series) was £390 14s. 9d., for 488 pages; and the cost of the present year's volume (XIX., new series) is £585 15s. 5d., for 680 pages.

The Board are glad to find that the suggestion made in last year's report, that the different affiliated societies should, immediately after their meetings, publish a short report of their proceedings in pamphlet form, containing abstracts of papers and reports of discussions, has been adopted by the Wellington Philosophical Society. It is understood that the effect has been greatly to revive the interest in the work of the Society, and it is hoped that the other affiliated societies will adopt the same practice.

It will be observed that, owing to the unusually large size of the volume of "Transactions," there is only a small balance to the credit of the Board this year, so that it has not been in a position to commence the publication of the quarto memoirs, as proposed in the same report.

A statement of accounts by the Honorary Treasurer is appended, by which it will be seen that there is a credit balance of £36 10s. 9d., besides about £45 in the hands of the London Agent.

James Hector,
Manager.

Approved by the Board.
G. M. Waterhouse.
30th August, 1887.

NEW ZEALAND INSTITUTE ACCOUNT, 1886–87.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
Balance in hand on the 22nd July, 1886 ..	60	15	11	For compiling Index to "Transactions" ..	10	0	0
Vote for 1886-87 ..	500	0	0	For printing Vol. XIX. .	535	15	5
Contribution from Wellington Philosophical Society, one-sixth of annual revenue ..	21	12	4	Contingencies . ..	0	2	1
				Balance in hand ..	36	10	9
	£582	8	3		£582	8	3

A. STOCK,
Honorary Treasurer.

29th August, 1887.

PROCEEDINGS.

WELLINGTON PHILOSOPHICAL SOCIETY.

FIRST MEETING: 15*th June*, 1887.

Sir James Hector in the chair.

New Members.—Mr. James Clark Gavin, and Count F. de Jouffroy d'Abbans.

The CHAIRMAN, in opening the business, remarked that the chief and, indeed, the only business which he had to perform was to introduce to them the President-elect, Dr. Hutchinson. In vacating the chair he had to thank the Society for the invariable kindness and consideration he had received from the members, and he had merely to express the hope and belief that the same kind consideration would be accorded to the President-elect.

DR. HUTCHINSON then assumed the chair, and read his inaugural address.

ABSTRACT.

Having congratulated the late President on the recent mark of esteem which he had received at the hands of his Sovereign, the speaker remarked that one of the greatest difficulties the colonists had to face was the general delicacy and want of resisting power in the rising generation, as was displayed in the very general premature decay of the teeth, and by nerve disease, and kindred disorders, which were caused by the crowding into towns, and the consequent evil effect of this overcrowding. He argued that if a healthy, vigorous race of colonists were to succeed the present generation, it could only be effected by a race of "country dwellers," in whom a surplus vitality might be stored "till it would be ready to burst forth upon the world." The inevitable tendency of society was to congregate in towns, and hence a want of vitality in the rising generation. He considered that, so far as the Universities were concerned, it would be far better to make these more teaching than merely examining bodies. He ventured to propose that the present system of primary and secondary education should be handed over to the New Zealand University, which should be made the one teaching body of the Colony, the machinery of the Education Department and of all the other public schools being transferred to it and placed under its charge. The President, at considerable length, dwelt upon the advantages of inculcating in the youth of the Colony a correct idea of the anatomical structure of the human frame, as being the best means of conducing to their own health, and then a healthy race would follow them. A purely secular education—"one that did not directly or indirectly lead the thoughts of youth above material and mental needs"—he was not in favour of. The speaker remarked that the aim of his address had been to draw a rapid sketch of his ideal, toward which it should be the aim of the colonists to attain.

Exhibits.—The Director exhibited and described the following specimens recently collected by members of the Geological staff:—

(1.) A large block of sandstone from Te Paretie Creek, Mohaka River, covered with a large and beautiful form of the genus *Flabellum*, probably a new species from the higher beds of Lower Miocene formation. A number of other fossils occur in the same block, among which is *Aturia ziczac*. These were collected by Mr. McKay.

(2.) A remarkable fossil shell from lower green-sand formation in the East Cape District (Awanui Series), collected by Mr. McKay, probably belonging to the genus *Margaritana*, allied to the freshwater pearl-shell of Britain. The characters of this fossil were described, and the relation of the beds from which it was obtained showed that this fossil would be of considerable value in assisting the recognition in the field of the horizon in the Lower Cretaceous rocks that yield bituminous shale and petroleum oil.

(3.) Specimens of a large fossil stalked Cirripede, recently collected by Mr. Park, at Motatapu Island, Auckland. A careful restoration will have to be made before definitely determining this fossil, but it will probably be found to belong to the genus *Scalpellum*, and is distinguished provisionally under the name of *S. aucklandicum*. In size, this fossil Cirripede greatly exceeds any previously known, in *S. magnum* the capitulum being only 1¼ inches in length, while in the Auckland specimen it is at least 8 inches. These fossils occur in a breccia, marking the old shore line of the upper part of the Waitemata Series, similar to the Cape Rodney beds. The associated fossils are *Corals*, *Brachiopods*, and *Echinoderms*. Among the latter are two specimens having plates of a *Cidaris* of enormous size.

SECOND MEETING: 6*th July*, 1887.

Dr. Hutchinson, President, in the chair.

New Member.—Mr. T. Trimble.

Papers.—1. "On the Dodders and Broom-Rapes naturalized in New Zealand," by Thomas Kirk, F.L.S. (*Transactions*, p. 182.)

2. "On the Occurrence of the Masked Plover in New Zealand," by T. W. Kirk. (*Transactions*, p. 33.)

3. "Ornithological Notes," by T. W. Kirk. (*Transactions*, p. 29.)

4. "On *Anthosoma smithii*," by T. W. Kirk. (*Transactions*, p. 31.)

THIRD MEETING: 10*th August*, 1887.

Dr. Hutchinson, President, in the chair.

New Member.—Mr. C. H. Pierard.

Papers.—1. "On Ancient Alphabets in Polynesia," by E. Tregear. (*Transactions*, p. 353.)

2. "Notes on Forestry," by J. S. Prendeville.

8. "Recent Explorations North of Chalky Sound, West Coast of Otago," by A. Reischek, with map (Plate XXII.).

An abstract of correspondence was read by Sir James Hector, who explained that Mr. Reischek, who is a well-known practical naturalist, had, with the assistance of the Government, been landed at Chalky Inlet in January last, and since then had been engaged in exploring the country between Chalky and Dusky Sounds. One of his principal objects was the discovery of further specimens of the interesting and rare bird *Notornis*. In this he had not been successful, but had obtained several geographical results of considerable interest, such as the discovery of five new lakes, hitherto unmarked on the maps, which he had named Lake Hector, Lake Thomas (after Professor Thomas, of Auckland), Lake Fraser (after the Hon. Captain Fraser), Lake Macarthur, and Lake Rimmer. He had also found about twenty square miles of good grass country, which he reported to be capable of pasturing about 1,600 head of cattle. This constituted a table-land, having an altitude of about 1,400 feet above the sea. The lakes described are in the mountains at the back of this plateau, and communicate with the sea by five deep ravines. Mr. Reischek had cut tracks in several directions, and for weeks together camped on the plateau and adjacent mountains, collecting geological specimens, and specimens of all the birds met with, of which he encloses a complete list, including forty-seven species. In January and February the weather was exceedingly trying, but for the last three months the weather has been fine, with only occasional storms and showers from the north-west, the prevailing south-easterly weather having been extremely fine and dry.

The following is a list of the birds collected by Mr. Reischek:—

Hieracidea novæ-zealandiæ, rare.
Hieracidea ferox, rare.
Circus gouldi.
Athene novæ-zealandiæ, rare.
Halcyon vagans, very rare.
Prosthemadera novæ-zealandiæ, rare.
Anthornis melanura, rare.
Zenicus longipes, rare.
Acanthisitta chloris.
Orthonyx ochrocephala.
Gerygone flaviventris, rare.
Certhiparus novæ-zealandiæ.
Petroica macrocephala.
Petroica albifrons.
Turnagra crassirostris, rare.
Rhipidura flabellifera.
Rhipidura fuliginosa.
Glaucopis cinerea.
Creadion carunculatus.
Creadion cinereus.
Stringops habroptilus, alpine variety, rare.
Platycercus novæ-zealandiæ.
Platycercus auriceps.
Nestor montana.
Eudynamis taitensis.
Carpophaga novæ-zealandiæ.
Apteryx australis, rare.
Hæmatopus unicolor.
Ocydromus fuscus.
Casarca variegata.
Anas chloris.
Hymenolaimus malacorhynchus, very few.
Lestris catarractis, very rare.
Larus dominicanus.
Dysporus serrator, rare.
Phalacrocorax brevirostris, rare.
Phalacrocorax, similar to *varius*.
Eudyptes pachyrhyncus.
Eudyptula minor.

FOREIGN BIRDS.

Turdus musicus.
Turdus merula.
Alanda arvensis.
Fringilla carduelis.
Fringilla chloris.

The attached map of the vicinity (pl. xxii.) shows: (1.) Lake Hector; (2.) Lake Thomas; (3.) Lake Fraser; (4.) Lake Macarthur; (5.) Lake Rimmer; (6.) and (7.) Lake Esau and Lake Dobson; (8.) Lake Cæsar; (9.) The Three Brothers; (10.) chain of mountains; (11.) hut; (12.) and (13.) tracks.

4. A fine series of specimens, presented by Mr. Docherty, from Dusky Sound, was exhibited, and their indications explained.

Mr. Docherty has been working single-handed, cutting tracks in the direction of Wet Jacket Arm, in continuation of his labours for some three or four years past, and has been successful in discovering a system of metalliferous veins and intersecting dykes, the contents of which are of interest to the mineralogist, and will probably prove of great economic value in the future. Sir James Hector exhibited a diagram map showing the district explored by Messrs. Reischek and Docherty, and referred to the existence of an area of many hundred square miles in that part of the Colony that had never yet been visited or explored.

5. "On the Occurrence of Black Sulphur in the Native State," by Sir James Hector.

The specimens were sent by Captain Mair, Rotorua, with the following note:—"I send you a matchbox full of funny little globules which I obtained from an active hot spring in the Waiotapu Valley, at the back of Maungakakaramea. They appear to be manufactured on the spot, and are thrown out by millions. I have never seen anything like them elsewhere." These globules proved on analysis to consist of sulphur 88·81 per cent.; water, 9·46 per cent.; carbon, ·24; loss 1·39. They were hollow spheres of irregular form, and appear to have been filled with steam when thrown up in the air, as they seem to have burst in falling by the formation of a vacuum in most cases. They were about the size of peas, and were interesting as being the first instance in which allotropic sulphur had been found in the natural state. Captain Mair also adds the following note with reference to the Tarawera disturbance:—"While in the Waiotapu Valley, on the 2nd July, 1887, we heard some extraordinary noises, apparently deep in the ground under our feet, and travelling along the earthquake rents from the north-east to the south-west. They occurred four times one day, and were like an express train dashing across an underground bridge. There was no perceptible tremor of the earth. The old Maoris to whom I mentioned the circumstance said the sounds were caused by the pent-up steam bursting into and filling large caverns in the earth. I do not know whether this is a scientific explanation, but it certainly seems a plausible one." Sir James Hector explained that it was about this time that great changes took place in the appearance of the district by the sudden rising of the waters of Rotomahana to their original level, while the new cold-water lake that had formed in the fissure since the eruption had disappeared; and it was probably the rushing of the underground waters, in establishing this readjustment of levels, that gave rise to the noises reported.

6. Samples were exhibited of trachyte tuff and breccia constituting the auriferous deposit recently found in the level ground west of Te Aroha. Collected by Professor Hutton, F.G.S.

The material, which appeared to be somewhat of the nature of an infiltrated quartz reef, which had been decomposed and then distributed as a surface deposit, was found to contain gold at a rate varying from 2 oz. to 14 oz. to the ton. The gold occurs in twisted angular flakes and grains, and is associated in a light felspar sand with heavier grains of quartz, mica, and titanic iron. It will probably prove to be the outcrop of an important reef, from which the sulphides have been removed by decomposition so that gold is left in its free state. The gold is the usual alloy of the district—consisting of gold 80·47 per cent., silver 16·91, loss 2·62, previous assays having varied from 77 to 84 per cent. This sample is, therefore, an average one.

7. Live specimens were exhibited of *Helix busbyi*, the large land shell, collected by Mr. Munce, at Hokianga, and also another live pair of the allied species of *H. hochstetteri*, recently obtained near Collingwood, in the South Island.

8. Photographs of native carvings and monuments in Easter Island, also of a map, presented by Mr. B. Biss, were exhibited.

FOURTH MEETING: *24th August*, 1887.

Dr. Hutchinson, President, in the chair.

New Member.—Mr. T. Wakelin, B.A.

Papers.—1. "On the Importance of Tide-gauges, and Description of a Simple Tide-gauge, invented by the Author," by Sir James Hector.

ABSTRACT.

This paper gave reasons for accuracy in our definition and records of what is known as the "sea-level," instancing its bearing on the value of property, as it is the datum line from which all land surveys are necessarily made; on the coastal navigation of the country, as any permanent changes in the level would affect the depth of water on shoals and sunken rocks; on the orographical features of the country, as it was the datum-line to which all altitudes used by engineers were referred. Yet the sea level was exceedingly variable. The chief variation was, of course, the well-known, but still imperfectly understood, diurnal tide caused by the influence of the Moon's attraction modified by that of the Sun, and to some extent also by the planetary influences. Theoretically, this great wave should sweep evenly round the globe, but, practically, it was first generated in the Southern Hemisphere, and thence travelled into the intricate land-locked oceans of the Northern Hemisphere. This at once indicated the important influence of the form of land and depth of oceans upon such waves. A variation in atmospheric pressure also affected the sea-level, and especially when it led to the propagation of surface-waves by violent storms or prevailing winds. Changes of sea-level were also due to vulcanicity, which caused an absolute change by shrinkage or expansion of a portion of the Earth's crust; and, lastly, in the case of earthquakes, (which were impulses induced by explosive action below the Earth's surface,) waves, though less transient in their effect, disturbed the sea-level on a much more gigantic scale than any of the preceding causes.

Tide records and barographs were to the physicist as the pulse was to the physician. Experience had shown that while the mercurial barometer and elaborate tide-gauges were essential to refined and accurate measurements, even a rough apparatus, if sufficiently inexpensive to allow of its being used at many stations, would give more valuable results for general purposes. He instanced the *data* obtained from tide-gauges at the time of the Krakatoa eruption; but these were not thoroughly reliable, on account of our not having sufficient points of observation to determine how such ocean waves as then spread over the globe were influenced by the form of land past which they swept, or by the tide-waves, and still more by the tidal currents set up in the narrow straits, which they encountered. A few years ago tide-gauges were set up at Lyttelton and Dunedin, and within the last few months one had been erected by the Harbour Board in Wellington. All these gauges were of the best and simplest forms at present known; but he pointed to the diagram of the Lyttelton gauge, and showed how it failed at the critical moment at the time of the Krakatoa disturbance, when the sea-level receded to at least three feet below the lowest water previously recorded. What was wanted, therefore, was a cheap simple tide-recorder, and plenty of them, at every lighthouse and every suitable point round the coast; and the result would be the accumulation of records that would have extreme value for future reference.

After much consideration, he had arrived at the form now exhibited, which was an adaptation of compound diagonal levers that moved vertically above and below a fixed point, the difference in the number of parallelograms above and below this point determining the degree to which the scale of motion is reduced, by an automatic pen marking a diagram on paper carried forward by clockwork. The model and drawings were then fully explained, and the hope expressed that before long this instrument or a similar one would be extensively used.

2. "Extraordinary Discovery regarding Generation in Insects," by W. M. Maskell, F.M.S.

In the "Comptes Rendus des Séances de l'Académie des Sciences" for February, 1887, M. Moniez announces a discovery of the greatest interest regarding generation in certain forms of life, and the so-called "parthenogenesis." *Lecanium hesperidum*, a Coccid or scale-insect very common in Europe and in New Zealand, has been known and studied most carefully for nearly two centuries without the discovery of any male insect. Amongst others, since Linnæus, who first observed the insect scientifically, Leydig and Leuckart, two German biologists of note, made very minute researches for the male without result. "Parthenogenesis," or the reproduction without male agency in every case, has long been known to obtain, for example in the *Aphides*, to some extent; that is to say, several generations occur in that family without sexual intercourse. But the male *Aphides* are known to exist; and, as far as information at present extends, this "parthenogenesis" only avails for a very limited series of generations, probably not more than eleven. In *Lecanium hesperidum*, however, the generations, apparently through female agency alone, were thought to be countless and unlimited; self-fecundation seemed to be the rule in this species. An additional peculiarity was given to this by the fact that in most of the other Coccids males were found, and, in the species where the male was not known, probably want of full observation quite accounted for its absence. The propagation of *Lecanium hesperidum* was therefore up to the present time a problem unsolved by the most careful inquiry, and apparently insoluble.

M. Moniez has, to a great extent, discovered the solution, but it is perhaps not too much to say that his explanation reveals a process even more extraordinary than "self-fecundation." He announces that he has discovered the male of *Lecanium hesperidum*, and that it exists entirely within the body of the mother; not only so, but that it undergoes in that position the same three metamorphoses as any other insect, having a larval, a pupal, and an "imago" stage: not only so, but that its sexual organs appear, and its spermatozoa are matured, in the second or pupal stage, before the appearance of the other members of the body. In the absence of eyes, and the tenderness of its non-chitinous skin, the male differs from the female larvæ found with it also within the mother's body: in the absence of wings, it differs altogether from all the other males of the Coccid family.

Further, if I understand rightly the summary which I have seen of M. Moniez's paper, these curious male insects, as they never leave the body of the maternal *Lecanium*, perform their sexual functions necessarily therein. It follows from this that a female *Lecanium* must be impregnated in its earliest, or larval, stage (for in that alone, besides as an egg, is she within the body of the parent): and, consequently, that the effect of the action of the male spermatozoa must remain dormant in the female larva after it emerges, and throughout the female pupal stage, and only become practical towards the close of the third, or adult, "imago" female stage.

I suppose this curious arrangement, if it be not unique in Nature, is at least exceptional in the highest degree. It seems contrary to all one's ideas of the fit sequence of things that a male animal should, at the time when it has to perform its functions, be not only incomplete but absolutely devoid of all organs except those for generation; and should afterwards, when there is no need for it, proceed to develope the remaining principal organs, head, body, legs, and so on. M. Moniez is not himself fully satisfied that he has discovered the full solution of the problem, nor can explain clearly the action of the male on the female larvæ enclosed with it. As regards the dormant retention of the reproductive power by the females from their earliest larval stage to their full maturity, that may be to some extent explained, perhaps, on Sir R. Owen's theory (Discourse on Parthenogenesis, 1849), in which a constant though limited succession of generations can be maintained without the action of the male in every case. This theory proceeds on the retention of the power of reproduction in some of the "nucleated cells" of the first female of the series. In the case, however, of *Lecanium hesperidum* it is not so much a question of transmission of power as of the repetition of the sexual act in every instance under very peculiar conditions: it is not a case of true "parthenogenesis." But M. Moniez is not sure that the males are to be found in every female *Lecanium*, and seems to think that there may be parthenogenesis sometimes. Anyhow, the discovery which he announces appears to be one of great importance, and deserves to be made known in this country now, even though the full text of his paper has not yet come out.

Sir James Hector agreed that this discovery was of the highest interest in its bearing on the deep question of the implicit memory involved in generation and the explicit memory evolved in adult growth. He, however, quoted parallel cases to show that it was not altogether an unexpected phenomenon. The essential feature of generation being the absolute death of the sperm or male element, by absorption into the germ or female element, it followed that in its simplest form the sperm never does survive generation. The latency of its influence on the germs, which appears in the case cited, until the female individual reached full development was paralleled by the history of many morbid growths, of which instances were mentioned. He trusted that this discovery would direct renewed attention to this profoundest of all questions in science: of how individual characters and memories of structures modified by habit can be concentrated in the simple sperm cell nucleus, to be again unfolded with unfailing fidelity.

Mr. Hudson mentioned that the *Diptera pupipara* exhibited in some degree a parallel to the extraordinary case mentioned by Mr. Maskell, the insect being retained within the body of the mother until developed into a pupa, and then deposited as a large abnormal egg, which soon hatches out into the perfect insect, capable of reproduction.

The President said that this was a subject of great importance—probably one of the most interesting questions that had ever been brought before the Society. We must await with eagerness the result of further investigation.

The remainder of the evening was occupied by the examination, under microscopes lent by various members, of slides illustrating the propagation and reproduction of *Algæ*. The following objects were exhibited:—

Penium margaritaceum,	conjugation,	with single smooth zygospore.
Closterium acerosum,	,,	,, ,,
Closterium lineatum,	,,	with double smooth zygospore.
Cosmarium stanmorense	,,	with spiny globular zygospore.

Spirogyra princeps, conjugation, with oval zygospores in the cells.
Micrasterias denticulata, in process of division.
Micrasterias ampullacea, „ „
Draparnaldia glomerata, with spores emerging from the cells.
Volvox globator, with "resting-spores" (*V. stellatus*, Ehr.).
Rhodymenia (species), with sections of coccidia and spores.

Also a slide exhibiting *Stauroneis fulmen*, a rare Diatom (reported only from New Zealand and Melbourne), from an extensive deposit of diatomaceous earth, Waverley, near Patea.

Exhibits.—1. Photograph of Prismatic Solar Spectrum, photographed by Mr. Ives, of Philadelphia, U.S., on an Ives' Chlorophyl-Eosine plate.

The negative was made with minimum exposure and forced development, to show the strongest possible contrasts. The action in red and orange is due solely to chlorophyl, that in yellow-green about one-third to chlorophyl and two-thirds to eosine, that in dark-green chiefly to chlorophyl. The visible spectrum appears strongest in deep red and weakest in blue—the exact reverse of an ordinary photograph in this respect, and a result which cannot be secured with any but a chlorophyl process. This was exhibited by Ven. Archdeacon Stock, who received it from C. Piazzi Smyth, Astronomer Royal of Scotland. Professor Piazzi Smyth, in sending this, remarks that with this photo-material sunsets may be photographed brilliantly; and peaches and oranges will come out brighter than the green leaves they are amongst.

2. The Marimba, or African piano.

This instrument was obtained from the Zulus, but, with various modifications, it is found in many parts of South Africa.

FIFTH MEETING: 14*th September*, 1887.

Dr. Hutchinson, President, in the chair.

New Members.—Dr. Hassell, Mr. Charles St. Barbe, and Major Campbell.

Papers.—1. "Remarks on a Collection made by Captain Fairchild, of Rocks from the Kermadec Islands," by Sir James Hector.

The rock specimens indicate the presence of trachyte and rhyolite, and also lava rocks, and with the latter are the breccias composed of large angular masses of a singular fibrous pumice, cemented by calcedonic quartz, the matrix also containing gypsum and magnetic iron. Some of the felspathic trachytes are so heavily charged with magnetic iron in fine grains as to give the rock the gravity and appearance of a basic rock.

2. "On a small-sized Specimen of the Hapuka, *Hectoria* (*Oligorus*) *gigas*, Castelneau, caught in Wellington Harbour," by Sir James Hector.

Young specimens of this well-known New Zealand fish are rarely met with. The New Zealand fish was separated by Count Castelneau from the Australian genus *Oligorus*, freshwater fish known as Murray Cod, on account of the presence of two instead of only one opercular spine. This young specimen (14 in. long) proves that this peculiarity is present, in an early stage of development. At the same time, the form of the young fish, it was pointed out, very much resembled that of the young Murray Cod. The author stated that he had found the Hapuka crowding, for the purpose of spawning, where large rivers fall almost direct into deep sea water, at the head of some of the West Coast Sounds.

3. "Notice of a Giant Sun-Fish (*Orthagoriscus mola*), cast ashore at Cape Campbell," and sent to the Museum, by Mr. A. Hansen.

Sir James Hector stated that the fish was of unusually large size (8 ft. long); it was not rare in mid ocean, but specimens were seldom cast on shore. A drawing of the fish by Mr. Hansen was exhibited, together with the measurements.

4. "Barbados, our earliest tropical Colony," by the Hon. J. W. Fortescue.

ABSTRACT.

This paper began by dealing with the history of the Island, its discovery by the Portuguese, who gave it its name; the first visit of Englishmen in 1605; its first settlement twenty years later by an English merchant; its transfer to Lord Willoughby, of Parham, by the original patentee; the proclamation of King Charles II. by that nobleman, in 1650; his suppression by the Parliament through Sir George Ayscue, and the re-establishment of the Parliament's authority; the utilization of the island for the Jamaica expedition, in 1655; and de Ruyter's attempted capture thereof ten years later.

After a brief description of the climate, with its temperature varying from 80° to 93°, and a rainfall of 55 to 57 inches; of the successive hurricanes, from 1675 to 1831; and of the geological formation, partly volcanic and partly coralline, if the usual accounts are to be accepted, the paper passed on to an account of the population.

The inhabitants are 180,000 in number, the area of the Island being 166 square miles. Of these 50 per cent. are African negroes, 40½ per cent. coloured, and 9½ per cent. pure whites. The negroes, albeit the merriest of men, are insolent, idle, thriftless, stupid, and sensual. The coloured people are unstable and divided, with the vices of both races. The whites are either hopelessly degraded—the "mean whites"—or degenerate and feeble, mentally and physically.

The paper dealt next with the Constitution, framed on the English model, but not responsible though representative, and the consequences thereof, as shown in Barbados in 1876, and in Jamaica in 1867. The cultivation of sugar was briefly touched on, and the backwardness of Barbados in regard to machinery, with its causes and consequences, shortly explained. The paper closed with a glance at the future: reviewed the political incapacity of the blacks, as illustrated by Hayti; the necessity for the maintenance of white supremacy; and the danger of prematurely entrusting the blacks with self-government, as threatened by the speeches of demagogues and humanitarians, and by the prevailing commercial depression.

Sir James Hector pointed out with reference to the sugar industry, that the success of the beet and sorghum sugar grown in temperate climates, though partly due to the manner in which they have been artificially fostered by a protective policy, was largely owing to the immensely improved mechanical and chemical appliances employed. Whenever the same chemical skill and capital was brought into operation on the tropical sugar production, the advantage of the natural difference in the richness of the saccharine element would certainly re-assert itself.

The President thanked Mr. Fortescue in the name of the Society for his lucid and interesting paper. He (the President) had also had experience, viz., in the Sandwich Islands, of the mistake of giving representative institutions to the lower races, and of the even greater evil of allowing members of the lower races to rule over white men. Representative government was now on its trial, and being strained almost to breaking point in the most highly civilized nations. For the lower races it is an absurdity. If given to the people of India, it could only be expected to prove their curse.

SIXTH MEETING: *5th October*, 1887.

Dr. Hutchinson, President, in the chair.

New Members. — Mr. W. W. Carlile, M.A., and Mr. J. Sinclair.

Papers.—1. "On Some Deep-seated Fallacies," by W. W. Carlile, M.A.

ABSTRACT.

Two fallacious tendencies in thought, which had indeed one source, were: (1) the tendency to give an imaginary priority to the abstract over the concrete; and (2) the tendency to personify general conceptions. The former had been a common source of bad philosophy, bad educational systems, and bad legislation. As an instance, might be cited the fact of a highly abstruse metaphysical discussion being placed as introductory in the series of Science Primers. Aristotle, on the contrary, had put "Metaphysics" in its right place —after "Physics." The very prevalent practice in schools of teaching the grammar of a language, even including the rules of syntax, before any knowledge of the language itself was obtained, was another. In the history of language itself the true progress had been from the concrete to the abstract, even the verb "to be" not having existed in many early languages. In Jurisprudence, custom necessarily preceded Law, contrary to the prevalent opinion that an Act of Parliament could do anything. In Constitutional History there had been a famous inversion. Locke had placed the "social contract" at the dawn of history, instead of placing it in its true position as the last result of English development. Rousseau took up the fiction and preached it as truth, and Europe took fire over it. However, it was to be observed that it was a fiction only when in its wrong place—not as Sir H. Maine and Mr. W. S. Lilly appeared to think, a fiction altogether. There was a parallel misconception to this last in a wider sphere. Because the old view of the connection between Reason and Nature seemed to be erroneous, therefore it was argued that "the Universe was mindless." The great inversion, of which all others were shreds and patches, was to be found in the "Timæus" of Plato. It was the Darwinian theory read backwards. Similarly, in Plato there was an inverted conception of the true process of thought. He looked on abstractions as the only real existences, and held, consequently, that "so long as a man is trying to study any sensible object, he cannot be said to have learned anything." The Platonic view of abstractions became the Realism of the Middle Ages. This Realism, as Professor Huxley pointed out, was rampant among us still, in the shape of the second fallacious tendency referred to—the personification of general conceptions. Professor Huxley regarded the tendency as liable only to mislead the careless and ignorant; but it was doubtful whether even the most cautious thinkers were not occasionally affected by it. Mr. Darwin, after describing the ball and socket *ocelli* on the wing feathers of the Argus pheasant, denied that the imitation of light falling on a convex surface which they exhibited could be the result of "chance." In denying Chance, he necessarily affirmed Intention. But where did the intention lie? That was the question of questions. In Mr. Darwin's no doubt historically accurate account of the phenomenon, there was no indication given as to where he thought the intention could be; yet he told us that thus, and thus only, could we *understand* it. Mr Darwin's opinion that his explanation rendered the phenomenon understandable was, perhaps, due to the fact that he unconsciously attributed Intention to his personified conception of sexual selection. In order to understand this tendency to personify abstractions, it was necessary to look at the process by which abstractions were made. Professor Huxley, in his book on "Hume," expressed the opinion that they were made by a process analogous to that by which compound photographs were made. "In dreams," he said, "the outlines of the hills are ill-marked, and the rivers have no defined banks. They are, in short, generic." One might as well say that those of Turner's pictures which conveyed the effect of a hazy atmosphere were generic. The general idea of "river," indeed, must include the most clearly as well as the most dimly seen. What we really did was to take one river, either real or imaginary, as our representative instance, and to say to ourselves: "Let this stand for river in general." In fact, we personified, or at any rate individualized, our conception of "river." Thus, abstraction was, in its very beginnings, based, in a sense, on illusion. The difficulty in the famous puzzle of "Achilles and the Tortoise" was due to this tendency to take our thought-image for a reality. When we had brought "Achilles and the Tortoise," or some more convenient symbols, as close together as we could imagine them to be without touching each other, we still left the *minimum visibile* between them. We then proceeded to halve this, or thought we did so, but in reality we conceived the *minimum visibile* over again as lying between them. We might, of course, continue that process indefinitely.

2. "On Maori Ancestry," by J. Coutts Crawford, F.G.S. (*Transactions*, p. 414.)

SEVENTH MEETING: 19*th October*, 1887.

Dr. Hutchinson, President, in the chair.

New Member.—Mr. J. Horne.

Papers.—1. "Polynesian Folk-lore, Part II.—The Origin of Fire," by E. Tregear, F.R.G.S. (*Transactions*, p. 369.)

2. "Notice of a Discovery of Illuminating Gas," by J. C. Crawford, F.G.S.

The writer stated that he had lately commenced to sink a bore for water on the flat land on the Hataitai Peninsula, somewhat nearer the western than the eastern hills. The bore passed through 54 feet of sand, and then through more than 40 feet of stiff blue clay, when yesterday afternoon the man in charge of the work was surprised by a sudden rush of gas up the pipe, preceded by the ejection of some water. The gas continues to rise in great force, it burns with a yellowish-red flame by daylight, white at night; there is no smell of sulphur, and it is reported as being a pure illuminating gas. There is nothing as yet discovered to show from what rocks the gas is derived, or under what conditions it is formed.

[Since the above meeting, Mr. McKay, of the Geological Department, has collected samples of the gas for test in the laboratory, and Mr. Skey found it to be marsh gas, or light carburetted hydrogen, which might answer for heating purposes, but not for illuminating. It is probably derived from the decomposition of swamp matter buried at a great depth from the surface; and this view has been confirmed by the cessation of the gas-escape after about seven days' duration.—J. HECTOR.]

EIGHTH MEETING: 17*th November*, 1887.

Dr. Hutchinson, President, in the chair.

Papers.—1. "On the *Korotangi*, or Stone Bird," by Major Wilson; communicated by Mr. Tregear.

2. "On Red Deer, and their Ways," by the Hon. J. W. Fortescue.

ABSTRACT.

The rapid increase of the various species of Deer that have been acclimatized in the New Zealand mountains, renders it interesting and important that exact information should be made known respecting their habits The author having enjoyed special facilities for acquiring such information, was led to communicate his observations to the Society.

Hinds consort with stags in their second year, and as a rule produce but one calf at a time; though there are instances of twins. The calves till four months old are white spotted. Male calves begin to grow horns in their second year, and as a rule have, till eight or nine years, larger horns every year. The age of a deer cannot be proved from his horns alone. Injury tells directly on the growth of the horns Castration of a male calf stops the growth of the horns. Partial castration has no such effect Castration of a stag causes the horns to be soft and to remain cased in the velvet.

Deer may often be distinguished in their sex by the manner of picking up their food, as in the case of turnips and growing corn. Both sexes of deer bite at a turnip till it comes out of the ground; but a stag has the stronger neck, so uproots them the quickest. A stag takes half an ear of corn, a hind the whole.

The slot, or footprint, of a stag differs from that of the hind, being broader at the heel and blunter at the toe. As a rule, the older the stag the blunter the toes, and the broader the heel. It is often difficult to distinguish between the slots of the hinds and of young male deer.

Generally speaking, all deer tend in extreme old age to revert to the appearance of their youth. The horns grow smaller, and in some cases the slot and body also. The points of the horns also are blunt and ill developed.

The shooting season for stags should begin when the new grown horn is fully developed, *i.e.* when the stag has shed the velvet, and should cease at the beginning of the rutting season. When stags begin to bell, or bellow, the rutting season has commenced. Hinds may be shot from the end of the rutting season for about three months, after which time they are too heavy in calf to be of much value, though barren hinds may be shot even in the spring.

Sir James Hector would like to ask Mr. Fortescue, as an expert on the subject, whether the chief use of the antlers was not so much for fighting, as for facilitating the progress of the stag through dense woods. He had considerable experience with the Wapiti, in North America, and found that by throwing up the head, thereby placing the horns along the back, the animals were enabled to go forward with great rapidity and follow the hinds. He asked this, as it had been stated at a previous meeting of the Society that the antlers tended to entangle the deer.

Mr Fortescue said that Sir James Hector was quite correct in stating that the antlers assisted the stags in penetrating dense forests.

Mr. Higginson also bore out this statement from his experience in India.

3. "On Earthquakes in New Zealand," by Sir James Hector.

This paper is an attempt to place on record all earthquakes that have been noted in New Zealand. The author held that earthquakes, like other natural phenomena, required to be classified. Until within the last few years this had been attempted only by theories of their origin. What is required is accurate description and record, so that the varieties may be differentiated. A classification somewhat of the following nature might be adopted: Thus, in the first place, earthquakes and volcanic action are popularly connected, and their relation is easily understood, but applies only in a comparatively few cases, as there are many other kinds of earthquakes that do not appear to be connected with volcanoes. Secondly, we may have a primary impulse radiated from a deep-seated focus of small diameter—of which the Charleston earthquake of 1st September, 1886, was a marked example. This spread 1,000 miles in all directions from a focus 12 miles beneath the surface. The area within which the vertical displacements exceeded the lateral was 26 by 18 miles, but the focal points were along a curved line only 12 miles in length. Even in this earthquake we thus see a tendency to a longitudinal extension of the focus, but the impulse that caused the primary shock was simultaneous. This leads to the next class of heavy earthquake shocks that have great longitudinal extension, and which generate fresh impulses successively as they are propagated through a tract of country in which the undulations meet with strata in a condition of stress. It is to this class we must refer the only two great earthquakes that have been recorded in New Zealand, as they were propagated from N.E. to S W. for a distance of at least 800 miles, while the lateral propagation was not more than 100 miles to the N.W. or S.E. A short abstract was given of the principal features of these two earthquakes, which occurred in October, 1848, and January, 1855, from the descriptions published at the time by Sir William Fitzherbert, and the late Judge Chapman. Lastly, we have slight tremors that frequently reach us, evidently from a great distance to the S.E., and which, except where they locally encounter superficial conditions of instability, do no material damage. They are widespread; and, if the undulations are circular, they must have an enormous diameter, as they affect New Zealand nearly as if they were straight lines.

The early records are necessarily very incomplete, and commence with the earthquake felt near D'Urville Island by Captain Furneaux on the 11th May, 1773. Subsequently only prominent shocks are referred to, until from the beginning of 1846 to October, 1848, when the shocks felt in Wellington were recorded. From that date until 1868 the record is very imperfect; but since 1868, when the present Meteorological Department was organized, and the telegraph brought into operation, the record has been tolerably complete for the whole Colony. The earthquakes during this latter twenty years have therefore been scheduled, the Colony being divided into six districts, each having a characteristic structural peculiarity, as shown on the map exhibited. An analysis of this schedule showed that during the period 587 earthquakes have been recorded: of which only 2 were recorded in the northern district of Auckland; 184 in the central district of the North Island; 183 on the east coast of the North Island; 88 on the west coast of the South Island; 98 on the east coast; and 30 in the extreme south. But of the above number 142 were felt only in the middle section of the North Island, between the South Taranaki Bight and the Bay of Plenty; 147 only in the district between the East Cape and Wellington; and 115 were confined to the east and south coast of the South Island. Of the whole number, only 7 could be identified as having been felt in places outside the Colony. In conclusion, a short reference was made to the modern views as to the causes of earthquakes, and especially to the important bearing of a recent paper by Mr. Autray Strachan, F.G.S., regarding the destructive effects of explosions from "slickensides," or smooth surfaces formed by motion along deep-seated faults, when these faults have been brought within reach of the miner's pick by the elevation of the land. It appears that these smooth-faulted surfaces are in a state of intense molecular tension, probably acquired through slight movements when under intense pressure at profound depths. The force thus stored may be liberated under certain circumstances by insignificant vibrations, and thus become an important factor in the generation of violent earthquake shocks. It at least points to a method, hitherto unsuspected, by which intense force may be stored up as a consequence of earth movements, without calling in the aid of the plutonic fusion of rock masses.

On the walls were exhibited specimens of the daily weather charts for the whole Australasian Group, which are now issued by the Government of Queensland under the superintendence of Mr. Clement Wragge, the Government Meteorologist.

NINTH MEETING: *30th November*, 1887.

Dr. Hutchinson, President, in the chair.

Papers.—1. "On a new Species of Large Decapod. (*Architeuthis longimanus*,)" by T. W. Kirk. (*Transactions*, p. 34.)

TENTH MEETING: *11th January*, 1888.

Dr. Hutchinson, President, in the chair.

New Member.—Mr. A. H. Turnbull.

Papers.—1. "Probable Discovery of the Physical Causation of Gravitation," by T. Wakelin, B.A.

ABSTRACT.

The following is a summary of the conclusions arrived at in the paper:—

(1.) That physical-science philosophers believe that gravitation must be caused by the action of some physical agent.

(2.) That no material agent can act directly on every particle of a very large body.

(3.) That probably some physical agent acts on the outside of the Sun, and of Jupiter, producing the motion of certain spots.

(4.) That the physical agent would act more strongly on the side of the earth furthest from the Sun, to deflect the earth in its course, than it does on the nearer side.

(5.) That this force acts more strongly at or near the centre of the earth's shadow; the part of the earth under a vertical sun having the force of gravity weaker than the average.

(6.) That the clocks at the surface of the earth at the places indicated should be affected accordingly.

(7.) That this variation in the force of gravity is about coincident with the average day and night and seasonal temperature, taking the variation in the force of gravity due to latitude into account.

(8.) That the temperature of the clocks generally is the same as the day and night and seasonal temperature.

(9.) That mercurial or other compensation is such as to make the clock go faster in summer and slower in winter than the proper rate.

(10.) That when regulating a clock for variations of temperature, the compensation may really compensate for day and night and seasonal variations in the force of gravity, coincident with the changes in position of the centre of the earth's shadow, as well as for day and night and seasonal variations in temperature.

(11.) That if compensation is made for a variation in the force of gravity, as well as for a variation in temperature, the quantity of mercury actually found necessary should be greater than the amount found sufficient by calculation to compensate for variation of temperature alone.

(12.) It is pointed out that the valuation of evidence is sometimes a matter of great difficulty; but it is hoped that the evidence afforded by the facts brought out by the regulation of the Melbourne Observatory clock will be considered clear.

(13.) The Astronomer Royal of Victoria, and Assistant Astronomer, kindly furnished the following information. The temperature of the clock is obtained by maximum and minimum thermometers in or on the clock:—

Weight of steel rod and fittings	1·92 lbs.
" cast-iron jar	4·38 "
" mercury	16 00 "
Diameter of jar (internal)	2¼ inches.
Length of jar "	8½ "
Half-swing of pendulum	1 deg. 58 minutes.

A model of this clock, exhibited by the maker, Chas. Frodsham, was exhibited at the Paris Exhibition, 1867, and found by the Horological Jury to be one of the best in existence.

(14.) The best authority on clocks then, Sir E. Beckett, (Encyclo. Brit., Art. "Clocks,") says that "a jar 2 inches in diameter requires the jar to be filled with mercury to a height of 6·8 inches." The Director of the Observatory found that 8½ inches was not sufficient to compensate for variation of temperature. The *rate*, however—a slightly losing one in summer, and a gaining one in winter—seems practically perfect.

(15.) In removing from the latitude of London to that of Melbourne *less* mercury should be required.

The paper concludes as follows:—

"The foregoing shows that the astronomical clock at the Melbourne Observatory has a quantity of mercury in excess of what is required to compensate for changes of length of pendulum due to changes of temperature, and that such excess probably compensates for variations in the force of gravity. If the jar had been filled to a height of 6·8 inches with mercury—the proper quantity to compensate for variations of temperature—then the Melbourne clock would have been too slow in summer and too fast in winter, this showing that the force acting on the pendulum—the force of gravity—would be stronger in winter than in summer.

"If the force of gravity is found to vary with the time of the year and the time of day, then it is shown that the force of gravity is the action of some physical agent.

"The facts and reasoning go to prove that such is the case. Thus is it shown that the physical causation of gravitation is probably discovered."

2. "On the Occurrence of Bismuthic Gold at the Owen Goldfields," by William Skey.

Abstract.

The author, after adverting to the fact that in February last he had in a paper to this Society announced the presence of metallic bismuth at the Owen Goldfields, but in quantity so minute that the metal as metal was invisible, went on to express the pleasure which he felt in being able to exhibit to the Society metallic bismuth from the Owen in the nuggety form. He then described the bismuthic gold (a sample of which was exhibited), and concluded his paper by giving its approximate composition, promising, however, a more extended and rigorous analysis as soon as further samples were available for the purpose.

This variety of gold, he said, was very rare, and within his knowledge was the richest in bismuth of any yet announced. This gold loses 11·62 per cent. in nitric acid: the loss is principally bismuth; the remainder is silver, wtih traces of copper.

Approximate composition:—

Gold	78·41
Silver	5·62
Bismuth	14·81
Copper	Traces.
Loss	1·16
	100·00

3. "On the General Association of Grains of Gold with Native Copper," by William Skey.

Abstract.

The author had tested the copper ores or rocks of D'Urville Island, Aniseed Valley, the Dun Mountain, and the Maharahara Ranges, Napier, and uniformly found a few specks of gold in each of these specimens, wherever native copper was present; and he also found that these gold specks were always the more numerous in the vicinity of the copper. The Aniseed rock was eminently chloritic, and did not contain any quartz, or indeed any free silica at all; neither hematite nor iron pyrites, the usual concomitants of gold; and it is not a rock that one would expect to find this metal in. In the heart of a solid nugget of almost pure copper were found several specks of gold, which must have been in absolute juxtaposition with the copper; yet he was unable to find that any gold had alloyed with the copper. The copper was remarkably pure, and gave no indications of being alloyed with either gold or silver.

Upon these results the author bases the hypothesis that gold in separate aggregations is a usual or constant associate of native copper; and in the particular instance of the native copper he examined (from the "Champion" lode), that it was deposited by an electrotyping process, and subsequent to the date at which the gold was formed in the rock.

The gold obtained from the Aniseed and the "Champion" lode specimens was exhibited at the meeting, and attention was directed to the fact that one of the specks obtained from the Aniseed crushing had the colour of an English sovereign, showing that it was likely to contain copper to the extent of some 10 per cent, a very high proportion for native gold.

4. "On the Formation of Bismuthic Iodides of the Alkaloids," by W. Skey.

Abstract.

This is an interesting series of salts prepared from bismuthic chlorides, by taking advantage of the fact which the author has discovered, that these are soluble in iodide of potassium.

The nicotina salt of this series is of a crimson colour, highly crystalline, and fuses at 212° F. to blood-red globules. The reactions of bismuthic iodide with nicotina salts is very striking, and, so far as is at present known, distinguishes nicotina from the other alkaloids. The corresponding antimony chlorides or oxides appear insoluble in alkaline iodides, hence an easy process by which they can be identified and separated from bismuth.

The bismuthic iodide of nicotina was exhibited.

5. "On *Henops brunneus*, Hutton," by W. M. Maskell, F.M.S. (*Transactions*, p. 106.)

7. "The Aryo-Semitic Maori," by E. Tregear, F.R.G.S. (*Transactions*, p. 400.)

At the close of the meeting Mr. W. M. Maskell moved a resolution to the effect that the Society should express its regret at the departure from Wellington of the President, Dr. Hutchinson, who is about to take up his residence in the Taranaki District, and also that the Society should place on record its high appreciation of the manner in which Dr. Hutchinson had fulfilled the duties of his office. In moving the resolution, Mr. Maskell said there were two ways in which they could regret his departure, first as an individual, and then as an official. He was sure that all those who knew Dr. Hutchinson in the City would deeply regret his departure. As an official, in his capacity as President of the Society, and as a member of the Council, he (Mr. Maskell) could not speak in too high terms of Dr. Hutchinson. He had not missed a single meeting, and had done everything that was required of him in a most courteous and urbane manner.

Mr. Pennefather seconded the motion.

Dr. Hutchinson said the resolution had taken him very much by surprise. It was a very great source of grief to him that he was going to leave Wellington and the Society; but there were other considerations. He could not stand the worry of professional life, and he desired a change. As it was the last time he would occupy the chair, he wished to tender his thanks to the members of the Council, and the Secretary, for the kindness they had always shown him.

The resolution was carried unanimously.

ANNUAL MEETING: 18*th February*, 1888.

W. T. L. Travers, F.L.S., in the chair.

1. The Annual Report and Balance-sheet were read and adopted.

ABSTRACT.

Ten general meetings have been held during the past year, at which 36 papers or short notices were read by the following gentlemen:—Messrs. W. M. Maskell, F.R.M.S., T. W. Kirk, T. Wakelin, B.A., W. Skey, Sir James Hector, T. Kirk, F.L.S., E. Tregear, F.R.G.S., J. C. Crawford, F.G.S., J. S. Prendeville, A. Reischek, Hon. J. W. Fortescue, and W. W. Carlile, M.A. Besides the above, an address was delivered by the President (Dr. Hutchinson). It was stated that an arrangement was made with Messrs. Lyon and Blair at the commencement of the year for the publication of the proceedings of the meetings in their "Monthly Record," and this had been carried out with great success, and met with the approval of the members generally and also the leading members of other Societies, who had expressed satisfaction at the step taken by the Society in this matter. The good example thus set would, it was hoped, have the effect of carrying out the suggestion made in the New Zealand Institute Report of 1886—viz., that each Society should publish its own proceedings. The Council wished that the thanks of the Society should be officially recorded to Messrs. Lyon and Blair, for the courteous and liberal manner in which they had met the wishes of the Society. Twelve new members had been elected during the year, and nearly 100 volumes added to the library, either by purchase or presentation. The balance-sheet showed an expenditure of £184 0s. 11d., which left a credit balance of £39 16s. 2d.

In moving the adoption of the report and balance-sheet, the Chairman spoke of the valuable assistance rendered by Dr. Hutchinson during his term of Presidency. He had been a most enthusiastic worker, and had always had the interests of the Society at heart. It was a cause of great regret by the Society that he had left them, but they could tender him their hearty thanks and wish him every success in his new sphere.

The report and balance-sheet were passed.

2. The following Office-bearers were then elected for the current year:—*President*—W. M. Maskell, F.R.M.S.; *Vice-presidents*—Hon. G. R. Johnson and Mr. A. de B. Brandon; *Council*—Sir James Hector, Dr. Newman, Messrs. Hulke, Govett, Travers, M'Kay, and Tregear; *Secretary and Treasurer*—R. B. Gore; *Auditor*—W. E. Vaux.

GENERAL MEETING.

Papers.—1. "Some Moot Points in Mental Science," by W. W. Carlile, M.A.

ABSTRACT.

In a recent paper the writer had alluded to Professor Huxley's theory of the mental process of abstraction—viz., that it was analogous to the physical process of taking compound photographs; that, accordingly, the vague representations of men, hills, and rivers in dreams might rightly be described as *generic*—and had maintained that this theory could not stand, because a general conception must cover contradictories, and contradictories could not be represented in one image. The question had been threshed out 200 years ago. Locke had alluded to the general idea of a triangle as one that "must neither be oblique nor rectangle, neither equilateral, equicrural, nor scalenon, but all and none of these at once." On this Bishop Berkeley had taken him to task in his gravely sarcastic fashion, observing that if any one could frame such an idea as this of a triangle "he would be sorry to dispute him out of it." The difficulty had not escaped Kant. Its solution, indeed, formed an important feature in his Philosophy. "No image," he observes, "could ever be adequate to our conception of a triangle in general." He was of opinion, therefore, that not images, but what he calls schemata, lie at the foundation of general conceptions. The schema is a sort of mental rule for the construction of a triangle, and is a product of thought as distinguished from reproductive imagination simply. The distinction was all-important. The two faculties were often in inverse proportion to one another. This radical error was the source of further error, in connection with the doctrines of necessary truth and causation. In Professor Huxley's view, the reminiscence "I was in pain yesterday," might "properly be said to be necessary." If that was so, the distinction between necessary certainty and ordinary certainty was wholly illusory; and, in that case, nearly all that had been called philosophy, from Plato to Hume, was idle words. The truth, however, was far otherwise. After some further argument and illustration, intended to bring out the writer's view of the character of necessary truth, he went on to say that Professor Huxley divided so-called necessary truths into two classes—(1) Identical propositions; (2) Truths of experience. Identical propositions, such as "A is A," depended on the possibility of intelligible speech. This took it for granted that it was the easiest thing in the world to say what was an identical proposition, and what was not. If we thought it out, however, it did not seem to be so. "Black is black" is an identical proposition, no doubt. What about "Black and white in alternate patches are piebald"? That was also, perhaps, identical. What about "Blue and yellow mixed are green"? That was certainly not identical, yet it stood on a different footing from a mere truth of experience, as we could see the blue and yellow in the green—that is, the whole cause in the effect. This seemed to him to make very clear the inadequacy of the famous Humist doctrine of causation, that "difference" and "constant conjunction" between two phenomena "are all the circumstances that enter into the idea of cause and effect." The truth rather was that we never wholly understood the causal connection between two phenomena till we perceived the identity between the cause and the effect. In illustration of this he cited a passage from Spinoza on the efficient cause of a circle.

2. "On the Occurrence of *Morchella esculenta*," by T. Kirk, F.L.S.

ABSTRACT.

This paper recorded what the author believed to be the first discovery in New Zealand of the true *Morchella esculenta*, a valuable edible fungus. The specimens described were collected near Otaki by Mr. C. W. Lee; but it is decidedly rare. The author mentioned that the reported occurrence of this fungus in Canterbury by Mr. Armstrong is evidently a mistake, the specimen from that district being *M. cornica*.

Mr. Travers said he had found this fungus in New Zealand some eight years ago. It commands a high price in Paris, and if it could be procured in quantity would prove a valuable source of revenue.

Sir J. Hector believed that it had been found in the Upper Hutt District.

3. "On the Hessian Fly," by W. M. Maskell, F.R.M.S.

ABSTRACT.

The identification of the wheat fly sent down from the Rangitikei District with the true Hessian fly (*Cecidomyia destructor*) is a matter of some importance. The larva, or maggot, answers entirely to that of *C. destructor*, possessing the peculiar appendage beneath the head, called the breast-bone, characteristic of the Hessian fly. The author had, at first, some doubt as to the veining of the wings, but has since been able to satisfy himself that the real Hessian fly has reached these islands The Hessian fly is, however, subject to much damage from the attacks of other insects—parasites as they are called. The author reported that in New Zealand it had no sooner arrived than it was attacked by parasites in the form of hymenopterous insects, probably of the family *Proctotrupidæ*, and indigenous to New Zealand.

Exhibits.—A specimen of the "bladder fluke" obtained from a rabbit captured at Dry River, Wairarapa, by Mr. Coleman Phillips, was exhibited by Sir James Hector.

The speaker said that this was one stage of the tapeworm of the fox, wolf, etc., and probably of the wild dog and cat. He further stated that in America he had seen large tracts of country cleared of rabbits in a few months by the propagation of this disease. This is the third time the disease has appeared in the Wairarapa; but the difficulty in this country will probably be to secure a proper host, as otherwise the worm cannot reach maturity, and the disease will die out.

AUCKLAND INSTITUTE.

FIRST MEETING, *6th June*, 1887.

Professor A. P. Thomas, President, in the chair.

New Members.—Dr. Leger Erson, H. Percival, and W. J. Robinson.

The President delivered the anniversary address.

SECOND MEETING. *4th July*, 1887.

Professor A. P. Thomas, President, in the chair.

New Member.—E. S. Von Sturmer.

Papers.—1. "Description of a Collection of Maori Articles bequeathed to the Museum by the late Mr. C. O. Davis," by T. F. Cheeseman.

The collection, which was a very valuable one, comprised a large series of Maori mats, including two dog-skin and three feather mats, in addition to the ordinary flax mats; several *taiahas*, paddles, spears, etc.; a greenstone adze, with a most elaborately carved wooden handle; wooden and whale's-bone *meres*; carved balers for canoes, and a variety of other articles.

The President and several other members spoke in reference to the value of the bequest.

2. "Two new Species of *Metaglymma*," by Captain T. Broun.

3. "New Experiments on the Nature of Colour," by B. W. Betts.

POPULAR LECTURE: 18*th July*, 1887.

Professor A. P. Thomas, President, in the chair.

"Pauperising the People," by E. A. Mackechnie.

POPULAR LECTURE: 15*th August*, 1887.

Professor A. P. Thomas, President, in the chair.

"The Extraction of Metals from their Ores," by Professor F. D. Brown.

THIRD MEETING: *29th August*, 1887.

Professor A. P. Thomas, President, in the chair.

New Member.—H. M. Wilson.

Papers.—1. "On the Ingenuity and Destructiveness of Rats," by A. Reischek. (*Transactions*, p. 125.)

2. "On the Growth of Transplanted Trees," by J. Baber, C.E. (*Transactions*, p. 186.)

3. "Notes on Hot Springs Nos. 3 and 4, Great Barrier Island," by C. P. Winkelmann.

This paper gives the result of the analyses of the waters of the two hot springs discovered last (see "Trans. N.Z. Inst.," vol. xix., p. 388), and an account of the discovery of a third and fourth spring in the same locality.

4. "On the Nature of Government, with special Reference to Property in Land," by J. Buchanan.

POPULAR LECTURE: 12th *September*, 1887.

Professor A. P. Thomas, President, in the chair.

"Foods and Beverages," by J. A. Pond.

FOURTH MEETING: 3rd *October*, 1887.

Professor A. P. Thomas, President, in the chair.

Papers.—1. "New Genera and Species of Plant-eating *Coleoptera*," by Captain T. Broun.

2. "Notes on the Three Kings Islands," by T. F. Cheeseman, F.L.S. (*Transactions*, p. 141.)

3. "Personal Representation: a Modification of Hare's System," by Professor Aldis.

A long discussion took place, in which the President, Mr. Speight, Mr. Vaile, Dr. Purchas, and others took part. Professor Aldis shortly replied.

POPULAR LECTURE: 17*th October*, 1887.

Professor A. P. Thomas, President, in the chair.

"Brains and Character," by Dr. Bond.

FIFTH MEETING: *31st October*, 1887.

Professor A. P. Thomas, President, in the chair.

New Members.—H. D. Johnson, W. J. Speight.

Papers.—1. A long discussion arose on Professor Aldis' paper on "Personal Representation," read at the previous meeting.

2. "New Species of *Silphidæ*," by Captain T. Broun.

3. "New Species of Spiders," by A. T. Urquhart. (*Transactions*, p. 109.)

4. "On the Age of the Deposits in Kent's Cavern, as an Index of the Age of Ethnological and Zoological Remains," by Rev. Mr. Tebbs.

5. "The Whence of the Maori," by W. H. Blyth.

SIXTH MEETING: *14th November*, 1887.

Professor A. P. Thomas, President, in the chair.

Papers.—1. "New Species of *Pselaphidæ*," by Captain T. Broun.

2. "Notes on the Geology of the Kermadec Islands," by S. Percy Smith, F.R.G.S. (*Transactions*, p. 333.)

3. "On Rock Specimens from the Kermadec Islands," by Professor A. P. Thomas. (*Transactions*, p. 311.)

4. "On the Flora of the Kermadec Islands, with Notes on the Fauna," by T. F. Cheeseman, F.L.S. (*Transactions*, p. 151.)

5. "On the Geology and Physiography of the King Country," by L. Cussen. (*Transactions*, p. 316.)

6. "On Rock Specimens from the King Country," by Professor A. P. Thomas. (*Transactions*, p. 306.)

7. "The Whence of the Maori" (continuation), by W. H. Blyth.

8. "The Fishes of the Mokohinou Islands," by F. S. Sandager. (*Transactions*, p. 127.)

ANNUAL GENERAL MEETING: *20th February*, 1888.

Professor A. P. Thomas, F.L.S., in the chair.

ABSTRACT OF ANNUAL REPORT.

Seven new members have been elected during the year. The losses, through death, resignation, and non-payment of subscription, amount to 30, there consequently being a decrease of 23. The total number on the roll at the present time is 255.

The revenue for the year has amounted to £962 5s. 1d., of which £184 16s. consisted of members' subscriptions, and £625 11s. 1d. interest on investments. The total expenditure has been £958 2s. 10d., leaving a small credit balance in the Bank of New Zealand.

Ten meetings were held during the session, at which 25 papers and lectures on various scientific and literary subjects were read.

The total estimated yearly attendance of visitors at the Museum was 32,367, being an increase of over 6,000. Brief mention was made of the chief additions to the Museum, the valuable bequest of Maori articles made by the late Mr. C. O. Davis being specially referred to.

ELECTION OF OFFICERS FOR 1888 :—*President*—S. Percy Smith, F.R.G.S.; *Vice-Presidents*—Professor A. P. Thomas, F.L.S., Professor F. D. Brown; *Council*—C. Cooper, Mr. Justice Gillies, Rev. E. H. Gulliver, Hon. Col. Haultain, E. A. Mackechnie, J. Martin, F.G.S., T. Peacock, M.H.R., J. A. Pond, Rev. Dr. Purchas, J. B. Russell, Rev. W. Tebbs; *Secretary and Treasurer*—T. F. Cheeseman, F.L.S., F.Z.S.; *Auditor*—J. Stewart.

PHILOSOPHICAL INSTITUTE OF CANTERBURY.

FIRST MEETING: *5th May*, 1887.

Mr. G. Hogben, M.A., President, in the chair.

Mr. R. M. Laing, M.A., was elected to fill the place on the Council caused by Dr. Irving's resignation.

Papers.—1. "Observations on some Railway Cuttings in the Weka Pass," by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 257.)

2. "Note on the Rat that invaded Picton in 1884," by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 48.)

3. "Note on two Volcanic Rocks from near Westport," by Professor F. W. Hutton, F.G.S.

The last paper was illustrated by microscopic sections.

SECOND MEETING: *2nd June*, 1887.

Mr. G. Hogben, M.A., President, in the chair.

New Members.—W. B. Worsfold, M.A., Rev. W. Hoatson, Rev. W. Rouse.

Papers.—1. "On the Meaning and Etymology of the Word 'dierectus' in Plautus," by Professor F. W. Haslam, M.A. (*Transactions*, p. 429.)

2. "On the Oxford Chalk Deposit," by H. Wilson, B.A. Read by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 274.)

THIRD MEETING: *7th July*, 1887.

Mr. G. Hogben, M.A., President, in the chair.

New Members.—T. W. Naylor Beckett, F.L.S.; W. J. Anderson, LL.D.; L. B. Wood, M.A.; J. P. Grossmann, M.A.; Robert Brown, Joseph Stevens, Herbert Elliott.

A discussion on "Reason and Instinct" was opened by the President. A number of members took part.

FOURTH MEETING: *4th August*, 1887.

Mr. G. Hogben, M.A., President, in the chair.

New Members.—Rev. J. O'Brien Hoare, Dr. Porter, W. A. Nalder.

Paper.—"On Lord Shaftesbury's 'Inquiry into Virtue' and the Utilitarian Theory of Morals," by W. Dinwiddie.

FIFTH MEETING: *1st September*, 1887.

Mr. G. Hogben, M.A., President, in the chair.

New Member.—G. T. Booth.

Papers.—1. "On some Fossils from Greymouth," by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 267.)

2. "Description of a new Land Shell," by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 43.)

3. "On the Greensands of the Waihao Forks," by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 264.)

The following resolution was passed:—

> "That the Philosophical Institute of Canterbury desire to express their deep regret at the great loss which this Institute and the whole community has sustained by the death of the late Sir Julius von Haast, who was the originator of the Institute and several times its President, contributing, by his constant work in various branches of science, and by his untiring efforts in many other ways, to extend its usefulness and influence, and who, moreover, by his explorations and discoveries has done so much both officially and privately to advance the intellectual and material progress of Canterbury and of the whole Colony of New Zealand: and they request the President to convey to Lady von Haast and her family their deep sympathy with them in their bereavement."

SIXTH MEETING: *6th October*, 1887.

Mr. R. W. Fereday in the chair.

Papers.—1. "On some Ancient Rhyolites from the Mataura," by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 269.)

2. "On a *Leucophyre* from the Gorge of the Selwyn," by Professor F. W. Hutton, F.G.S. (*Transactions*, p. 271.)

3. "Supplement to a Monograph of the New Zealand *Noctuina*," by E. Meyrick, B.A., F.G.S. (*Transactions*, p.44.)

4. "Notes on New Zealand *Geometrina*," by E. Meyrick, B.A., F.G.S. (*Transactions*, p. 47.)

5. "Notes on New Zealand *Pyralidina*," by E. Meyrick, B.A., F.G.S. (*Transactions*, p. 62.)

6. Notes on New Zealand *Tortricina*," by E. Meyrick, B.A., F.G.S. (*Transactions*, p. 78.)

7. "Descriptions of New Zealand *Tineina*," by E. Meyrick B.A., F.G.S. (*Transactions*, p. 77.)

8. "On a Theory of Bird-Flight," by J. Warburton. Communicated by Professor F. W. Hutton, F.G.S.

ANNUAL MEETING: *3rd November*, 1888.

Mr. G. Hogben, M.A., President, in the chair.

New Members.—Dr. Bancroft, J. L. Colledge, P. W. Hill.

The annual report and balance-sheet were read and adopted.

ABSTRACT.

During the session six ordinary meetings have been held, at which seventeen papers were read, classified as follows: Geology, 7; Zoology, 8; Miscellaneous, 2.

In addition to the ordinary meetings, a course of popular lectures have been delivered under the auspices of the Institute, with very great success.

During the session, 17 new members have joined the Institute, and 15 names have been struck off the list. At present the number of members is 118, as against 116 last year.

During the session the Institute has, in common with the whole community, sustained a great loss by the death of the late Sir Julius von Haast, who was the originator of the Institute and several times its President, and who contributed by his constant work in various branches of Science, and by his untiring efforts in many other ways, to extend its influence and usefulness.

Large additions have been made to the Library. It is hoped that it will soon be possible to issue a catalogue of the books and pamphlets belonging to the Institute.

The balance-sheet shows the total receipts during the past session to be £147 0s. 8d., and total expenditure £145 4s. 4d., leaving a credit balance of £1 15s. 11d. The reserve, consisting of the subscriptions of life members, now amounts to £68 16s. 9d.

Office-bearers.—The following gentlemen were elected officers for 1888:—*President*—Professor F. W. Haslam, M.A.; *Vice-presidents*—G. Hogben, M.A., S. Hurst-Seager, A.R.I.B.A.; *Secretary*—W. Dinwiddie; *Treasurer*—H. R. Webb, F.R.M.S.; *Council*—Professor F. W. Hutton, F.G.S.; Professor C. H. H. Cook, M.A., W. H. Symes, M.D., R. M. Laing, M.A., R. W. Fereday, F.E.S., T. Crook; *Auditor*—C. R. Blakiston.

The retiring President read an address: "*In memoriam* Sir Julius von Haast, K.C.M.G., F.R.S., D.Sc., etc."

The President stated that the Council of the Institute had determined to send to England for a portrait of the late Sir Julius von Haast, to be placed in the rooms of the Institute, and, further, that the Council desired to bring the fund for founding a scholarship, to perpetuate the memory of the deceased, before the members for their favourable consideration.

OTAGO INSTITUTE.

First Meeting · 10*th May*, 1887.

The meeting took the form of a conversazione.

Second Meeting : 14*th June*, 1887.

F. R. Chapman, President, in the chair.

New Members.—Rev. Rutherford Waddell, M.A., Rev. James Gibb, M.A., Professor F. B. de M. Gibbons, M.A., L. O. Beal, junr., Robert Campbell, P. Duncan, H. F. Hardy, R. C. Jones, Henry Mackenzie, J. Macpherson, M.A., A. W. Morris, W. H. Pearson, R. E. N. Twopeny, Thos. Whitson.

Papers.—1. M. Max Muret exhibited a model, and gave a description of a new rowing apparatus invented and patented by him. After remarks from Messrs. Twopeny and Wilson, and Professor Brown, the Chairman asked the last-named gentleman to make a practical trial of the invention along with M. Muret, and to report to a future meeting.

2. "On the Middle Voice in the Latin Verb," by Rev. H. Belcher, LL.D.

3. "On the Derelict Ship in Facile Harbour, Dusky Bay," by Dr. Hocken. (*Transactions*, p. 422.)

Third Meeting : 12*th July*, 1887.

F. R. Chapman, President, in the chair.

Papers.—1. "Notes of an Expedition to the Big Bay District," by R. Paulin.

2. "On Hawarth's Patent Safety Cage," by George J. Binns, F.G.S.

3. "On a Specimen of *Regalecus*, recently stranded in Otago Harbour," by T. Jeffery Parker, B.Sc., C.M.Z.S. (*Transactions*, p. 20.)

4. "An Account of recent Researches on the Pineal Gland and the Median Eye of Vertebrates," by T. Jeffery Parker.

Exhibits.—(1.) The President exhibited a photograph, taken by Mr. E. A. Chapman, (of Grampian Station,) of snow crystals, collected in the Mackenzie country. The crystals, which varied in diameter from ⅛th to ⅝th inch, showed all the forms of 6-rayed stars as commonly seen in ice under the microscope. (2.) Mr. Paulin exhibited a collection of minerals made by him in the Big Bay District. (3) Mr. Haworth showed a working model of his patent safety cage. (4.) Professor Parker exhibited the skeleton and stuffed skin of the large ribbon-fish (*Regalecus*) described by him, both splendidly mounted by the museum taxidermist, Mr. E. Jennings. (5.) Professor Parker showed microscopical sections of the pineal eye in embryo lizards.

FOURTH MEETING: 9*th August*, 1887.

F. R. Chapman, President, in the chair.

New Member.—Mr. Walter Graham.

Dr. Hocken delivered a lecture on "The History of the Otago Settlement," being the seventh of the series on "The Early History of New Zealand."

The Chairman congratulated the Institute on the increasing interest taken in its meetings, as manifested by the large audience present.

FIFTH MEETING: 15*th September*, 1887.

F. R. Chapman, President, in the chair.

New Member.—Mr. George Gordon.

Dr. Hocken delivered his second lecture on "The History of the Otago Settlement," being the eighth of the series on "The Early History of New Zealand."

SIXTH MEETING: 14*th October*, 1887.

F. R. Chapman, President, in the chair.

Rev. Dr. Belcher delivered a lecture, the second of the series, on "The Theatre of the Greeks," dealing especially with the masks and costumes of the actors.

ANNUAL GENERAL MEETING: *8th November*, 1887.

F. R. Chapman, President, in the chair.

New Member.—Mr. G. G. Bridges.

Papers.—1. "On new New Zealand Plants," by D. Petrie, M.A., F.L.S. (*Transactions*, p. 185.)

2. "Descriptions of new Species of New Zealand *Araneæ*," by P. Goyen. (*Transactions*, p. 133.)

Mr. Petrie described the habits of some of these spiders, especially referring to two aquatic species. One of these, which was to be found in the water-races in the goldfields districts of Otago, ran up and down the stems of water plants, and carried a bell of air under the abdomen. They were unable to dive, and, when irritated, made for some portion of plant growing on the surface. The other species builds its nest in the form of tubes, under water, and could remain submerged for five or six hours at a time. It frequently occurred in littoral pools between tide-marks.

3. "Notes on some described Species of New Zealand *Araneæ*," by P. Goyen. (*Transactions*, p. 140.)

4. Notes on New Zealand Crustacea," by George M. Thomson, F.L.S.

Exhibits.—Professor Parker exhibited and made remarks upon several new and interesting additions to the Otago Museum, including the following:—

(*a*.) Specimens of three species of New Zealand Sharks.

(*b*.) A very large specimen of New Zealand Sole.

(*c*.) A series of specimens of the Nelly or Giant Petrel, showing remarkable diversity of plumage: the first was sooty black, the second brown, the third light-brown, marked with patches of white, and the fourth pure white with only a few black feathers.

(*d*.) A collection of birds' eggs, to show a new and very effective method of mounting.

(*e*.) Specimens of Tuataras, and Mutton Birds, to show the natural *habitat* of these animals.

ABSTRACT OF ANNUAL REPORT.

During the session seven general meetings have been held. At three of these lectures were delivered; one took the form of a conversazione; and at the other three, nine papers were read. The Council notes the increased attendance of members at the meetings, but regrets that so few original papers have been read. It also regrets that research papers of great value should be sent away to other countries, on account of the difficulty of getting suitable illustrations executed in the Colony, and also on account of the want of publicity hitherto attained by papers printed in the "Transactions of the New Zealand Institute."

During the year 17 new members have been elected, but several names have been removed from the roll, which now shows an actual membership of only 187.

The total actual receipts for the year, (including a balance of £67 2s. from the previous year,) amount to £199 19s. 6d., and the cash expenditure to £114 19s. 5d.; leaving a balance to credit of account of £85 0s. 2d., subject to outstanding liabilities. The sum of £221 12s. 9d. is on fixed deposit. The balance of assets over liabilities is £253 5s. 7d.

ELECTION OF OFFICE-BEARERS FOR 1888:—*President*—Alex. Wilson, M.A.; *Vice-presidents*—F. R. Chapman and Dr. de Zouche; *Hon. Secretary*—George M. Thomson, F.L.S.; *Hon. Treasurer*—J. C. Thomson; *Auditor*—D. Brent, M.A.; *Council*—Rev. H. Belcher, LL.D., D. Petrie, M.A., C. Chilton, M.A., Dr. Hocken, Professors Parker, Scott, and Gibbons.

Hon. Member.—Baron von Ettingshausen was nominated as an honorary member of the New Zealand Institute, in room of the late Dr. Carpenter.

The retiring President then delivered an address.

ABSTRACT.

After alluding to the life and services of the late Sir Julius von Haast, he referred to the Jubilee of Her Majesty the Queen, and reviewed the growth of the Colonial Empire of Britain during her reign. He further pointed out the contrast between the condition of affairs in the reign of George III., and that of Queen Victoria, in all parts of the British Empire. When Queen Victoria came to the throne there was no settlement in New Zealand in the ordinary sense. In the North Island there were whaling stations, and a considerable trading settlement had sprung up at the Bay of Islands; but with the exception of the missionaries, and some of the whalers and traders of the better class, the population was a very vicious one. Lawless sailors and still more lawless expired convicts formed the bulk of the people, and, without law or restraint, their morality was of the loosest order. In this island there were only a few scattered whaling stations. Two years after the commencement of the reign the first settlers sailed for New Zealand; and six months after this, law was established and the Colony became in a feeble way a settled State. He (the speaker) did not propose to trace all its vicissitudes. It had, and still has, many advantages over its neighbours; but it had in early times a drawback to which none of the others were subject, in the shape of frequent and long wars. He then touched upon the causes of the present commercial depression, and discussed the questions of Protection and Free Trade, and absentee land-owners.

At the conclusion of the address he introduced his successor, Mr. A. Wilson, M.A., who took the chair.

WESTLAND INSTITUTE.

Abstract of Annual Report.

The number of members on the roll is 80. During the year twelve ordinary and four special meetings were held.

The income has been, (including a balance brought forward from the previous year of £26 4s. 4d.,) £164 2s. 4d., and the expenditure amounted to £180 14s. 1d., of which £42 15s. was spent on periodicals. The assets are exceeded by the liabilities to the amount of £8 6s. 9d.

Election of Officers for 1887-88:—*President*—Rev. H. G. Gould; *Vice-president*—John Nicholson; *Treasurer*—A. H. King; *Trustees*—J. W. Souter, —. Sammons, J. G. Roberts, H. Atkinson, C. G. Broad, M. L. Moss, J. N. Smythe, G. Clarkson, F. E. Clarke, R. Cross, Capt. Bignell, J. P. Will.

HAWKE'S BAY PHILOSOPHICAL INSTITUTE.

FIRST MEETING: *9th May*, 1887.

The President, J. Goodall, in the chair.

1. The President delivered an address.

Exhibits.—The Hon. Secretary, Mr. Hamilton, exhibited a collection of mineral ores, and read some notes on the specimens.

Some curious little "bombs" of black sulphur, brought by Mr. Hill from the Waiotapu Valley, were specially noted.

SECOND MEETING: *18th June*, 1887.

The President, J. Goodall, in the chair.

Papers.—1. "On 'The Report on the Tarawera Eruption,' by Professor Hutton," by J. Hardcastle. (*Transactions*, p. 277.)

A long and interesting discussion arose on the reading of this paper.

2. "On the Artesian Well System of Hawke's Bay," by H. Hill, B.A. (*Transactions*, p. 282.)

This was a long an interesting paper, fully illustrated by diagrams, etc.

THIRD MEETING: *11th July*, 1887.

The President, J. Goodall, in the chair.

A discussion on Mr. Hill's "Artesian" paper was the first business.

Papers.—1. "A Description of a new Species of *Coccinella*," by W. Colenso, F.R.S. (*Transactions*, p. 40.)

2. "On some new Cryptogamic Plants from the Seventy-mile Bush, Taupo, etc.," by W. Colenso, F.R.S. (*Transactions*, p. 212.)

A large number of mounted specimens of the plants described were passed round for inspection.

FOURTH MEETING: 15*th August*, 1887.

The President, J. Goodall, in the chair.

Papers.—1. "On Ancient Tidal and Sea-Lore," by W. Colenso, F.R.S. (*Transactions*, p. 418.)

2. "On a Stereoscopic Aspect of the Moon," by J. Hardcastle. (*Transactions*, p. 428.)

Exhibits.—Mr. Colenso exhibited some interesting specimens, among them were two samples of naturally variegated wool, sent to him by Mr. Balfour, of Glenross. Also a couple of ancient coins, one a *denarius* of Julius Cæsar, found, curiously enough, on the Napier Hills.

The Hon. Secretary, Mr. Hamilton, exhibited a very beautiful specimen of the adult White Heron, or *Kotuku*, with very fine dorsal plumes.

FIFTH MEETING: 12*th September*, 1887.

The President, J. Goodall, in the chair.

Papers.—1. "On Olfactory Physics," by W. I. Spencer.

2. "On newly-discovered and rare Phænogamic Plants," by W. Colenso, F.R.S. (*Transactions*, p. 188.)

Exhibits.—The Hon. Secretary, Mr. Hamilton, exhibited some curious land shells, forwarded for the Museum by Mr. Chambers. Also a very fine specimen of an *Ammonite*, brought by Mr. Hill from Kaikora, H.B., and a collection of rock specimens from Mount Tarawera.

SIXTH MEETING: 19*th October*, 1888.

The President, J. Goodall, in the chair.

Papers.—1. "A Jubilee Paper: or, Fifty Years in New Zealand," by W. Colenso, F.R.S.

2. "On some newly-discovered Indigenous Cryptogams," by W. Colenso, F.R.S. (*Transactions*, p. 284.)

3. "On Sexual Plumage," by Mr. Taylor White, of Wimbledon, Wainui. (*Transactions*, p. 89.)

4. "On some Marine Invertebrates of Hawke's Bay," by A. Hamilton.

SEVENTH MEETING: 14*th November*, 1887.

The President, J. Goodall, in the chair.

Papers.—1. "On the Distribution of Pumice," by H. Hill, F.G.S. (*Transactions*, p. 293.)

Exhibits.—The Hon. Secretary, Mr. Hamilton, exhibited a number of specimens lately added to the Museum, notably:—

(1.) An albino specimen of a Weka (*Ocydromus*) from Mohaka.
(2.) A cinnamon-tinted variety of the wild Pigeon.
(3.) A fine specimen of a *Polynöe* (probably a new species), sent from Castlepoint by Mr. Harding.
(4.) Specimens of stone from Maharahara, containing copper pyrites.
(5.) A large collection of fossils from the Napier limestones and the Petane beds.

ELECTION OF OFFICERS FOR THE YEAR 1888:—*President*—W. Colenso, F.R.S; *Vice-president*—J. Goodall, C.E.; *Council*—R. C. Harding, H. Hill, R. Lamb, T. C. Moore, W. I. Spencer, W. Wood; *Hon. Secretary and Treasurer*—A. Hamilton; *Auditor*—T. K. Newton; *Curator of Museum*—A. Hamilton.

SOUTHLAND INSTITUTE.

FIRST MEETING, 31*st May*, 1887.

Ven. Archdeacon Stocker, President, in the chair.

Business.—Arrangements for winter course of lectures; President's address.

SECOND MEETING: 28*th June*, 1887.

Ven. Archdeacon Stocker, President, in the chair.

Business.—Final arrangements for lectures.

Paper.—"On the Structure of Matter," by A. Highton, B.A.

THIRD MEETING: 8*th November*, 1887.

Ven. Archdeacon Stocker, President, in the chair.

Business.—Statement of lecture receipts and expenditure.

Paper.—"On the Tarawera Eruption," by W. S. Hamilton.

NELSON PHILOSOPHICAL SOCIETY.

4th April, 1887.

J. Meeson, B.A., President, in the chair.

Exhibits.—Mr. R. T. Kingsley exhibited a large specimen of obsidian from Tuhua, presented by Captain Fairchild.

Mr. A. S. Atkinson exhibited: (1.) Slab of limestone from Collingwood coalmine, with very fine impressions of leaves of exogenous trees; (2.) Three shells from the Pacific Islands; (3.) A cuirass of cocoa fibre, from Kingsmill Island.

The President exhibited a new species of the Dodder (?), and read a short paper on the same.

Paper.—"A few Suggestions on Matter and Energy," by W. Wells.

Council Meeting: *21st April*, 1887.

J. Meeson, B.A., President, in the chair.

The Bishop of Nelson made a request that the valuable painting, "Tasman's Bay," by J. Gully; also two paintings by the same artist, his own property, might be hung in the Museum. Agreed to.

The Council decided to form a School of Mines in connection with the Philosophical Society.

2nd May, 1887.

J. Meeson, B.A., President, in the chair.

Papers.—1. "Notes on Natural History," by Hugh Martin, junior.

2. "On a Recent Ascent of Mount Arthur and Mount Peel," by Dr. Hudson; illustrated by photographs taken by R. T. Kingsley, and a sepia drawing by J. Gully.

6th June, 1887.

The Bishop of Nelson, Vice-President, in the chair.

Paper.—"Measurable Vibrations in Fluids, as suggestive of those only conceivable in Ether," by George Ashcroft.

A variety of highly interesting experiments were shown, illustrating the subjects touched upon.

Council Meeting : *4th July*, 1887.

J. Meeson, B.A., President, in the chair.

In pursuance of a suggestion offered by Sir James Hector, F.R.S., etc., Dr. Boor and R. T. Kingsley, in conjunction with H. Budden, were requested to obtain a collection of the Flora of the Dun Mountain for investigation.

4th July, 1887.

J. Meeson, B.A., President, in the chair.

Contributions to Museum.—The Curator announced a number of presentations to the Museum.

Paper.—"On Yeast," by Dr. Keyworth.

1st August, 1887.

J. Meeson, B.A., President, in the chair.

New Member.—Dr. Mackie.

Contributions to Museum.—The Curator announced the donation of a collection of Moa bones by the President; also the purchase of a fine male specimen of the Kakapo, of a different species from the common (*Stringops habroptilus*), obtained in the neighbourhood of Dusky Sound.

Paper.—"Notes of a recent Visit to the Hot Lakes; together with later information regarding the district affected by the volcanic eruption of 10th June, 1886,"by J. Holloway.

The paper was profusely illustrated with photographs taken before and after the eruption, also with interesting volcanic specimens from the district.

In the discussion, the Bishop of Nelson remarked upon the considerable changes that had taken place in the aspect of the district, since his visit after the eruption, especially in the condition of the elevations and lakes.

5th September, 1887.

A. S. Atkinson, Vice-President, in the chair.

Paper.—"The Genesis of Genius," by H. L. Twisleton.

Annual Meeting: *4th October*, 1887.

The Bishop of Nelson, Vice-President, in the chair.

New Members.—A. R. Atkinson and G. Bartel (late Associate).

Exhibits.—The Curator exhibited a living specimen of lamprey (*Geotria australis*) which, as far as Mr. Kingsley was able to ascertain, was the first recorded specimen captured in New Zealand, and read a short account of the same.

There is a description of it, and a drawing, in vol. v. of the "Transactions," p. 272, and it is there stated as being found in Australia and Stewart Island.

Paper.—A short communication was read from Mr. T. H. Pott, respecting "Some curious Carvings on a Rock at Chatham Island."

This paper was kindly communicated by request of the Society, an account of same having appeared in a newspaper. The paper was accompanied by a water-colour sketch of same, executed by Miss Stodart, subsequently photographed by Mr. C. Y. Fell.

Abstract of Report.

During the past year eleven ordinary and fourteen Council meetings were held. The papers read numbered thirteen. The Curator reports that the number of specimens added to the Museum by presentation and purchase were valuable and numerous, and that the Museum is in a very satisfactory state, both in regard to the arrangement and preservation of the objects it contained. It had been well resorted to by visitors.

Election of Officers for 1887–88:—*President*—Dr. Boor; *Vice-presidents*—The Bishop of Nelson and Mr. A. S. Atkinson; *Treasurer*—Dr. Hudson; *Secretary*—Dr. Coleman; *Council*—J. Holloway, R. T. Kingsley, Dr. Cressey, G. Ashcroft, and Dr. Mackie; *Curator*—R. T. Kingsley.

The President delivered his parting address.

Abstract.

After congratulating the Society on the interest of its proceedings, although the number of original papers was not large, and the well-attended meetings which had been held during the past year, he pointed out that it was not only in preparing original papers that members could assist in forwarding the interests of the Society, and went on to suggest several methods of increasing its usefulness and largely extending its operations. One step in that direction had already been taken in the matter of the proposed Mining School, the classes for which would be successively inaugurated next November. The following are the speaker's remarks on this subject:—

In a community like that of the Province of Nelson, where a very small number of the useful arts and occupations are established, and human industry runs altogether in few channels, it is of the very last importance that provision should be made for technical instruction, such as that which is given in the *Real-schule* of many cities on the Continent of Europe, and such as that also which is being given in the various technical colleges of England. Statesmen are continually addressing themselves to the question of the importance of establishing varied industries in our midst. Technical education would be one way to accomplish this, and a far better way than bounties and protective tariffs. If young people had the means of finding out for what they had natural taste and aptitude, they would be more diverse in their choice of occupation. At present the office or the plough is the alternative, the former meaning genteel poverty, and the latter a rougher struggle for existence. The Darwinian law may be inevitable, but human wisdom can surely mitigate the rigour with which it falls on poor humanity. To ameliorate the condition of people in a new land, the best way would perhaps be to introduce variety into the life of its inhabitants, which unfortunately tends to be altogether too groovish if left to itself and the operation of natural laws. How better do this than by acclimatizing new industries and occupations? And again, how better accomplish this than by teaching the useful arts, and allowing the love for them and the scientific investigation which they involve to grow up in the human mind while it is plastic?

Another reason why technical education should be encouraged may be found in the fact that nowadays the apprenticeship system is altogether dying out, and therefore the old system of extended schooling is gone; and unless technical classes be formed, particularly as legitimate amusement in a new country is limited both in amount and variety, the young people of a colony are likely to find themselves in the position of those who, as the Spaniards say, rather tempt the devil than are tempted by him; and furthermore, if, as a community, even in the face of bad times and a falling revenue, we are indisposed to cut down our present large expenditure on public education, for very consistency's sake we should try and make that education as thorough and as modern as possible. At present, however, we are doing nothing of the kind. Even in old countries, where technical education, from one point of view at all events, is less needed than here on account of the diversified occupations of the people at large, the attention that has been devoted to, and the money that has been spent upon, the establishment of technical colleges and classes, are so great that as a community we ought indeed to take shame to ourselves for what must be characterised as culpable neglect. It is in this matter as in many others. If, as a people, we spend money on an object, we think we discharge our duties in reference to it. We do not trouble ourselves as to *how* the money is disbursed. We are more just and liberal with dollars than with thought, though we must know that there is much debt that dollars cannot discharge, but only employment of loving labour and patient thinking.

The fact is, what is now taught in the public schools of the Colony is not real education at all, but only elementary instruction; it is the means of acquiring education, but not the thing itself. It produces no real love for learning, no true curiosity to probe into the secrets of Nature, no anxiety to acquire manual skill, no pride in excellence of workmanship, no devotion to truth and nobility. Neither reverence for what is truly great, nor ability to be practically useful, nor recognition of native talent, the responsibility which it entails and the pleasure which result from its further development, can be expected to result from a meagre system of cram, such as we have at present in our scheme of public instruction. And although it would be too much to expect that all these beneficial results would necessarily spring from courses of technical training, it may fairly be said that some of them would.

The encouragement, therefore, of every effort in the direction of technical education for the community in which it exists, must be regarded as one of the legitimate duties of a Society which professedly aims at the increase of human knowledge. And it is clear that in this, as in many other matters, it is only the making a beginning which is difficult. Once get classes fairly established for the teaching of both the practical and theoretical branches in the art of mining, and other classes, in which the theory and practice of other arts can be acquired, will soon be demanded and supplied. It is already proposed that the South Kensington Department of Science and Art should largely extend its sphere of operations and establish branches in the various British colonies. The Mining School will form the node or nucleus for such a branch in Nelson. A School of Design is the next desideratum, and it ought not to be long before that is established. Other departments should spring up by natural development, and will undoubtedly do so if the inhabitants of the district vouchsafe to the movement that popular support to which it is entitled.

He next referred to the importance of popular lectures and conversaziones, in which amusement could be efficiently blended with instruction, as further methods of increasing the Society's influence. The remainder of his address was devoted to arguing the claims of the prosecution of Science and Literature by those engaged in active business, as a means of developing a condition of sound mental health.

COUNCIL MEETING, *5th December*, 1887.

Dr. Boor, President, in the chair.

The Bishop of Nelson was nominated to vote at the election of a Governor of the New Zealand Institute.

Donation.—"The Zoology of Victoria," by F. McCoy, F.R.S., by the Public Library, Museum, etc., of Melbourne.

5th December, 1887.

Dr. Boor, President, in the chair.

Donations.—Twenty-four geological specimens, by Mr. H. P. Washbourne. "Official Report of the Observations made on the Transit of Venus, 1882," by J. McKerrow, Surveyor-General of the Colony; by the author, through Mr. A. S. Atkinson.

Paper.—"A few Experiences of Fijian Life," by W. E. Atkinson.

COUNCIL MEETING: *26th December*, 1887.

Dr. Boor, President, in the chair.

Donation.—"The Mining Industries of New Zealand for 1887," from the Mines Department (Govt. of N.Z.).

COUNCIL MEETING: *27th January*, 1888.

Resolved.—To open the School of Mines on the 31st January, with addresses from the President and other gentlemen, including Professor Black.

6th February, 1888.

Dr. Boor, President, in the chair.

Donation.—Fine specimen of chorl (?) crystal, embedded in chlorite schist.

Exhibits.—The Curator exhibited 20 specimens of Graptolitidæ, and read a short paper thereon.

Paper.—"On Minerals at Nelson," by H. P. Washbourne. (*Transactions*, p. 344.)

The paper was intended to show, (1.) the need of analysis; and (2.) the natural advantages the Nelson District possesses for smelting ores.

APPENDIX.

Meteorology.

Comparative Abstract for 1887 and previous Years.

STATIONS	Barometer At 9.30 a.m.		Temperature from Self-registering instruments read in Morning for Twenty-four Hours previously.					Computed from Observations.		Rain.		Wind.		Cloud.
	Mean Reading.	Extreme Range.	Mean Temp. in Shade	Mean Daily Range of Temp.	Extreme Range of Temp.	Max. Temp. in Sun's Rays.	Min. Temp. on Grass.	Mean Elastic Force of Vapour.	Mean Degree of Moisture. (Saturation = 100).	Total Fall in Inches.	No. of Days on which Rain fell.	Average Daily Force in Miles for Year.	Maximum Velocity in Miles in any 24 hours, and Date.	Mean Amount (0 to 10).
Auckland	30·046	1·980	59·6	12·6	46·5	147·0	26·0	·413	78	37·710	181	142	738, 29th April.	
Previous 23 years...	29·973	...	59·1	.	..	..	.	·395	73	42·782	187			..
Wellington	29·931	1·670	54·9	13·1	52·0	150·0	23·0	·347	79	56·960	188	226	750, 26th Dec.	4·1
Previous 23 years...	29·921	...	54·7		...	.	...	·337	72	51 773	158			
Dunedin	29·781	1·972	51·7	15 5	62·0	147·0	24·0	·286	73	39 144	174	132	570, 10th May.	5·5
Previous 23 years...	29·875	..	50 3	..	.	..		·277	74	34·665	164	..		...

Average Temperature of Seasons, compared with those of the previous Year.

STATIONS.	Spring. September, October, November.		Summer. December, January, February.		Autumn. March, April, May.		Winter. June, July, August.	
	1886.	1887.	1886.	1887.	1886.	1887.	1886.	1887.
Wellington	56·9	56 1	66·9	67·4	61·5	62·5	51·2	52·0
Auckland	58·8	59·	61·7	63·0	56·9	56·9	46·4	47·6
Dunedin	51·5	48·8	57·9	62·1	53·1	52·7	42·5	43·3

NOTES ON THE WEATHER DURING 1887.

January.—Fine warm weather throughout this month, with little rain and moderate wind. Earthquakes recorded at Wellington on 16th, at 4 a.m., slight, and on 31st, at 6.20 p.m., slight, E. and W. Comet observed in south at Lincoln on 25th and 26th, at 10.30 p.m., in S.W. horizon.

February.—On the whole, fine bright warm weather, with little rainfall and moderate wind.

March.—The weather during this period has been generally fine, with small rainfall and moderate wind.

April.—A fine month throughout, with rainfall less than the average, and moderate wind. Earthquake at Rotorua on 28th, slight, and at Wellington on 12th, E., and long. Meteor observed in south, on 29th, to east.

May.—Rainfall considerably in excess of average, and on the whole an unpleasant month, with strong wind. Earthquakes recorded at Wellington on 18th, at noon, very slight; and on the 22nd, at 2 a.m., slight.

June.—Early part of month at most places fine, but on the whole wet, with occasional strong winds. Earthquake at Rotorua on 21st, at 1.50 p.m., slight; and at Wellington on 11th, at 9.30 p.m , sharp, and 27th, E. to W., at 1.50 p.m., sharp.

July.—Generally a wet month; temperature above average; prevailing S.W. and N.W. winds, and strong at times.

August.—Except in north, the rainfall over the average, and temperature below; on the whole a wet squally cold month. Earthquake at Wellington on 18th, at 6.35 a.m., slight.

September.—A wet, stormy, and cold month generally.

October.—Rainfall in excess of average, and generally cold stormy weather during this period. Earthquakes at Wellington on 6th, at 7 a.m. and 10.30 p.m., slight.

November.—A cold and rather unpleasant month for time of year. Earthquakes recorded at Rotorua on 18th, slight, and Wellington on 11th, at 2 a.m., smart. Meteor observed in south on 9th, N.E. to S.W.

December.—Small total rainfall, but weather generally windy and cold for time of year. Earthquake at Rotorua on 18th, at 11.30 p.m., slight.

EARTHQUAKES reported in NEW ZEALAND during 1887.

PLACE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Rotorua ..	..	..	29	28	..	21	..	..	..	..	13	18	5
Napier	..	..	..	12*	..	..	..	..	..	..	..	..	1
New Plymouth..	..	..	..	15*	..	..	..	..	..	..	..	..	1
Waipukurau ..	..	..	..	..	..	..	..	5	..	..	..	..	1
Masterton ..	..	..	..	..	..	..	..	..	..	..	..	18*	1
Kaitoke	..	..	..	..	13	..	..	..	..	..	..	..	1
Wellington ..	16, 31	..	15	12	13, 22	11,* 27*	..	13	..	6	11*	..	11
Christchurch ..	.	..	..	..	..	..	..	9	..	..	..	..	1
Culverton ..	..	..	..	..	..	..	..	9	..	..	..	..	1
Amberley ..	..	..	..	..	..	..	..	9	..	..	..	..	1
Rangiora ..	..	..	..	..	..	..	..	9	..	..	..	..	1

NOTE.—The figures denote the day of the month on which one or more shocks were felt. Those with an asterisk affixed were described as *smart*, those with a dagger as *severe shocks*. The remainder were only slight tremors, and no doubt escaped record at most stations, there being no instrumental means employed for their detection. These tables are therefore not reliable as far as indicating the geographical distribution of the shocks.

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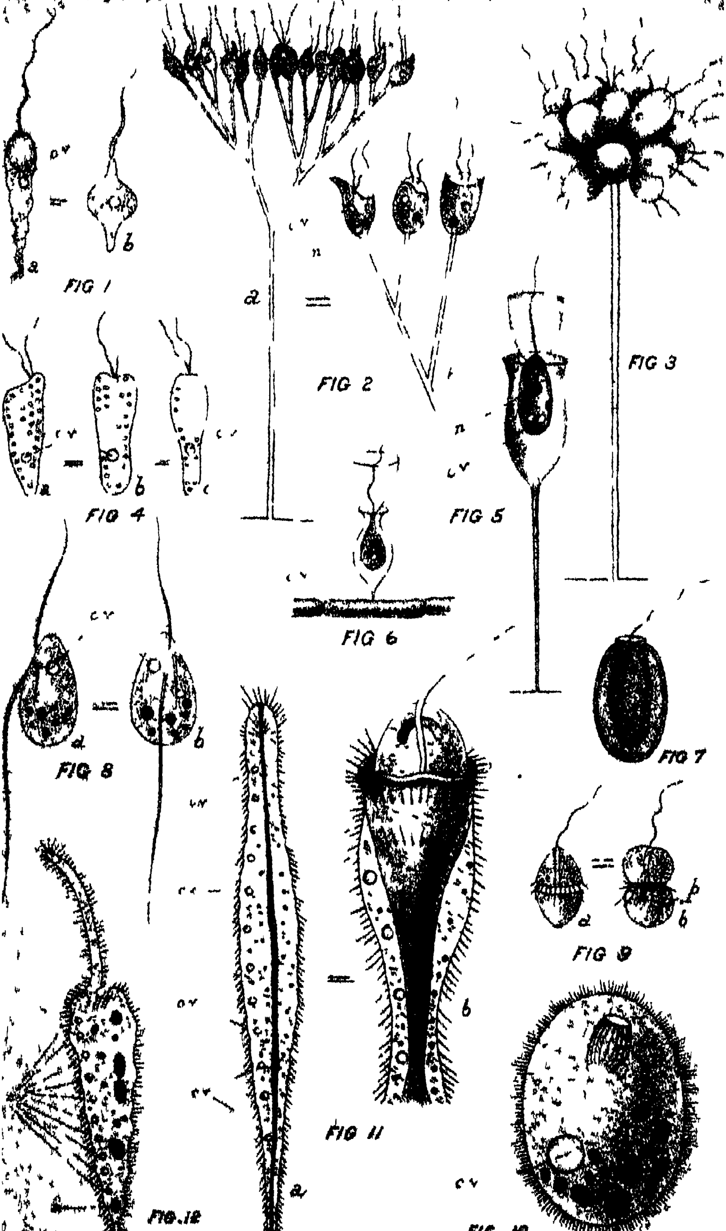

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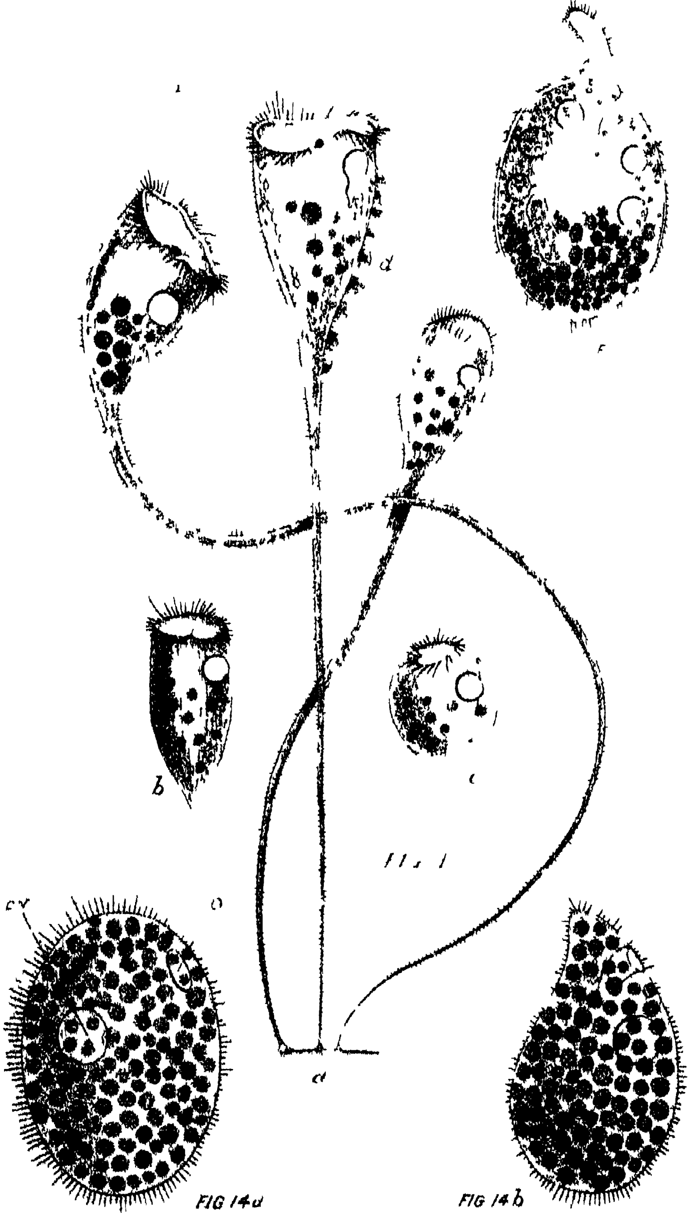

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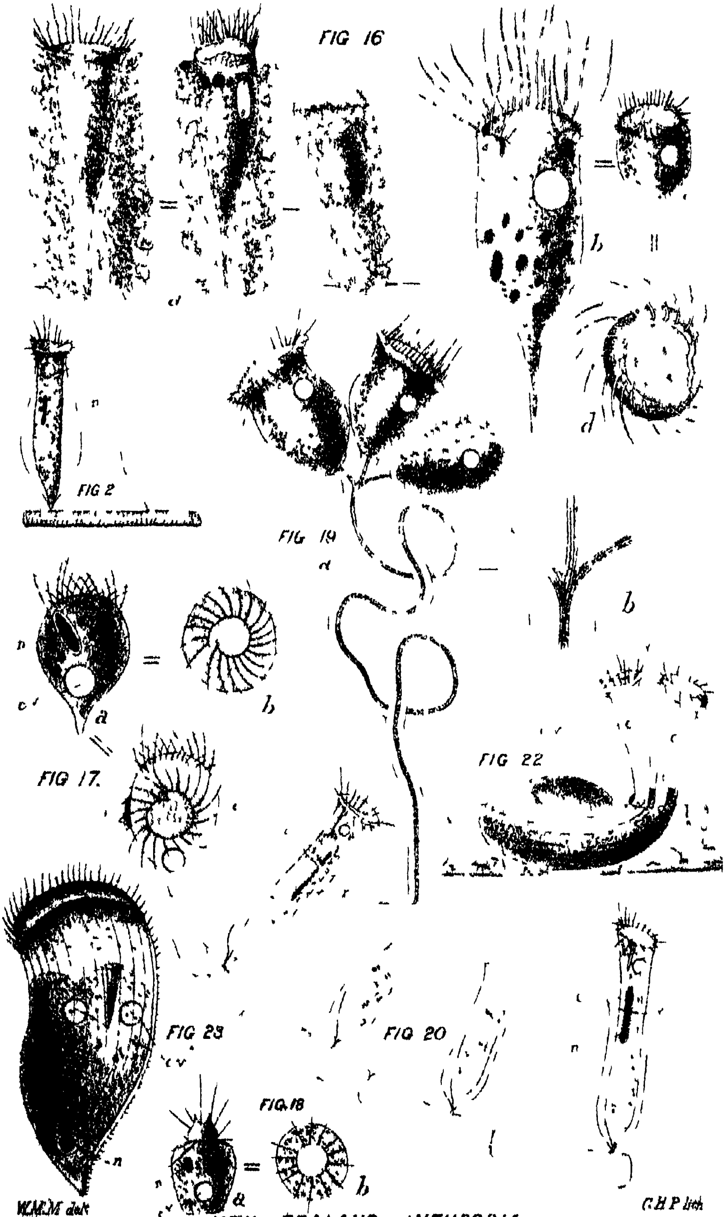

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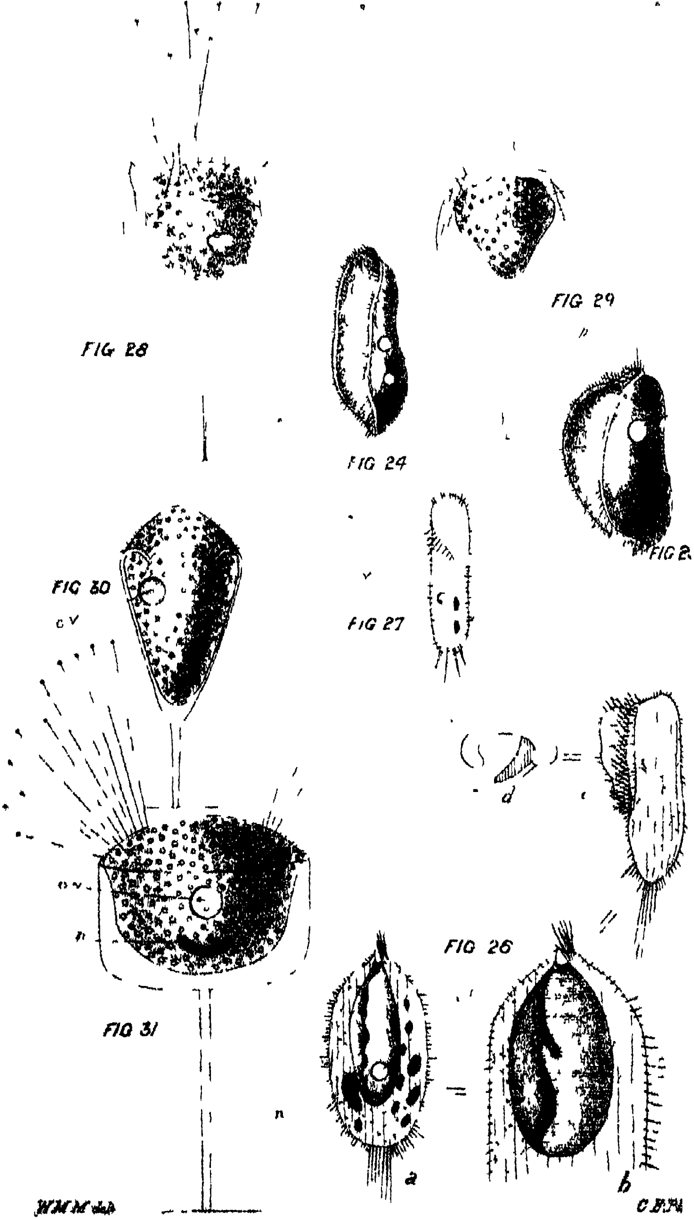

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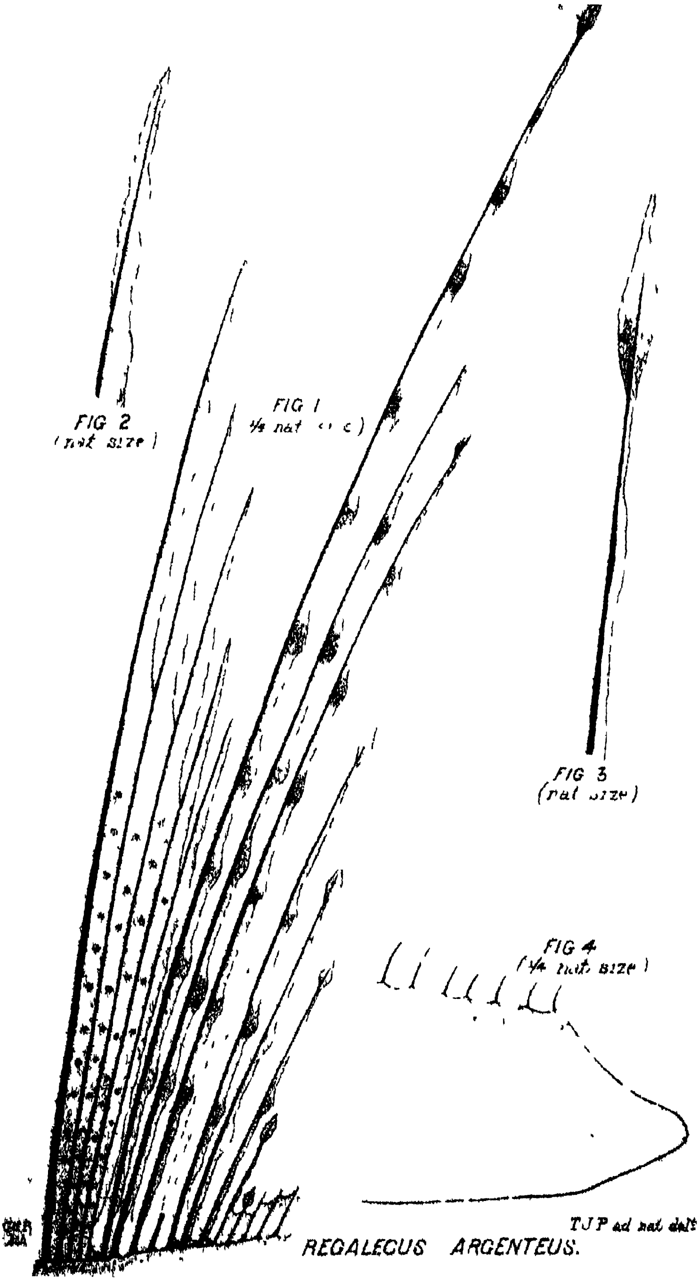

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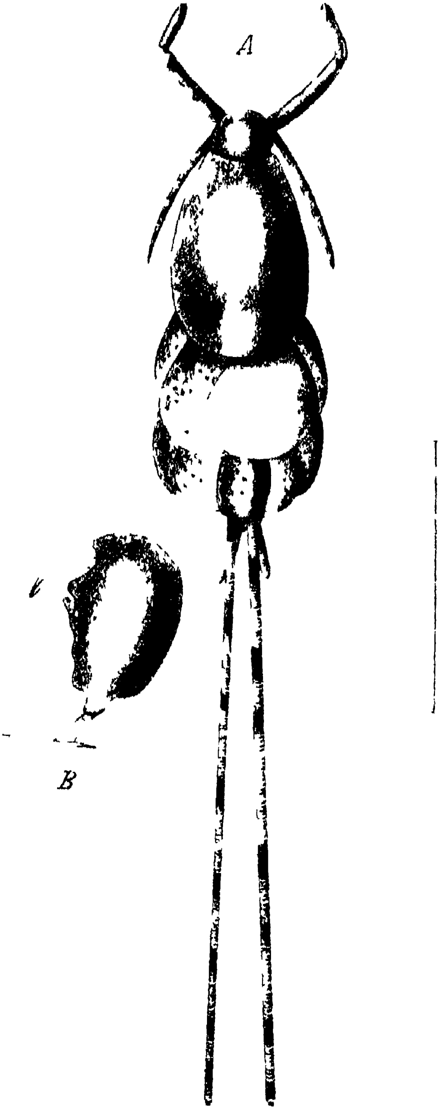

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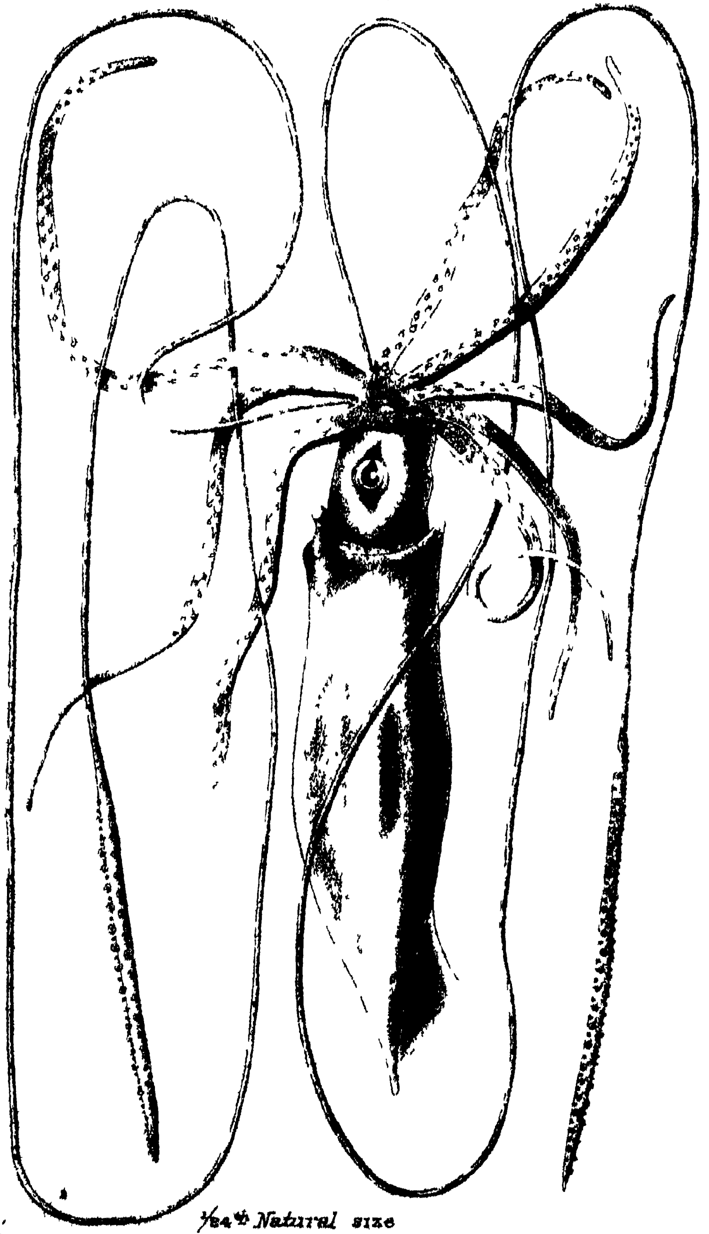

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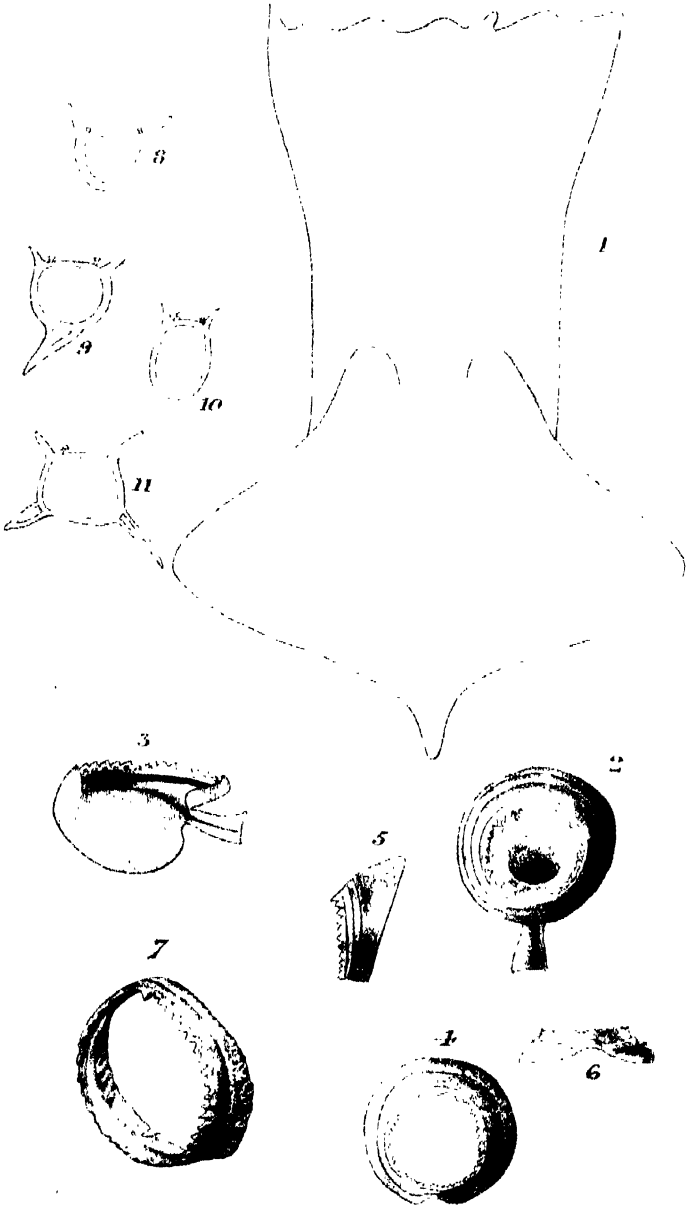

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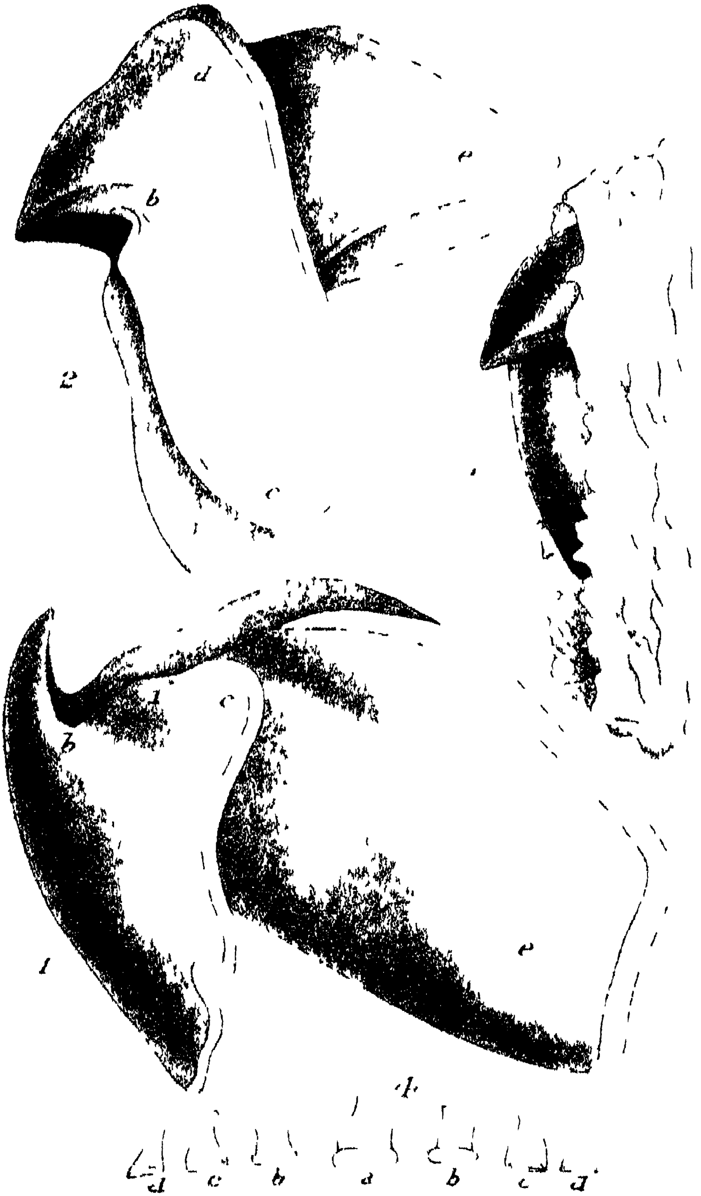

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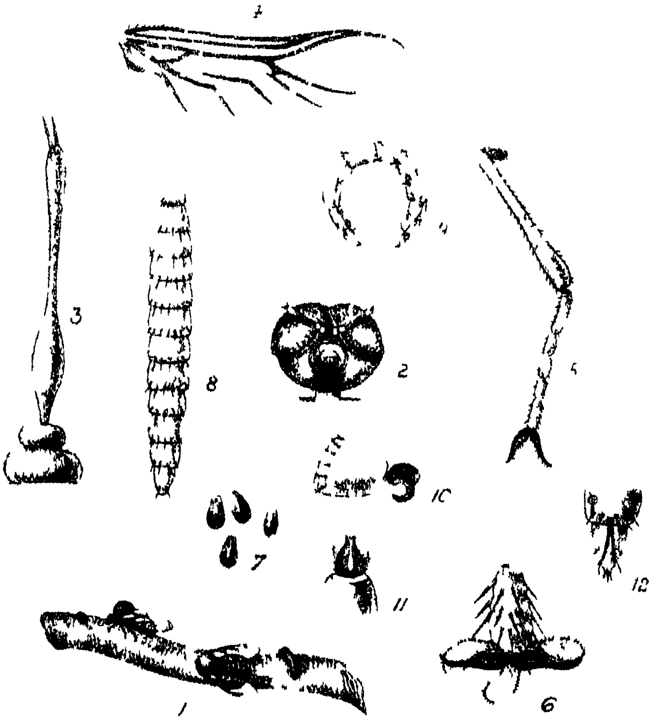

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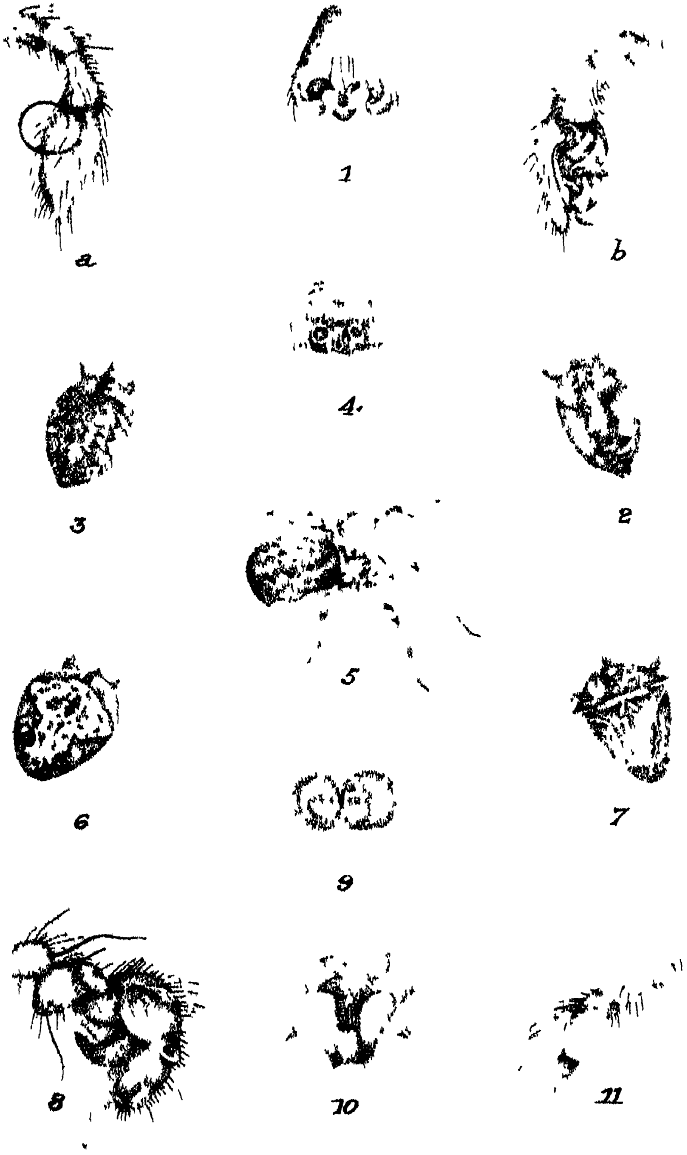

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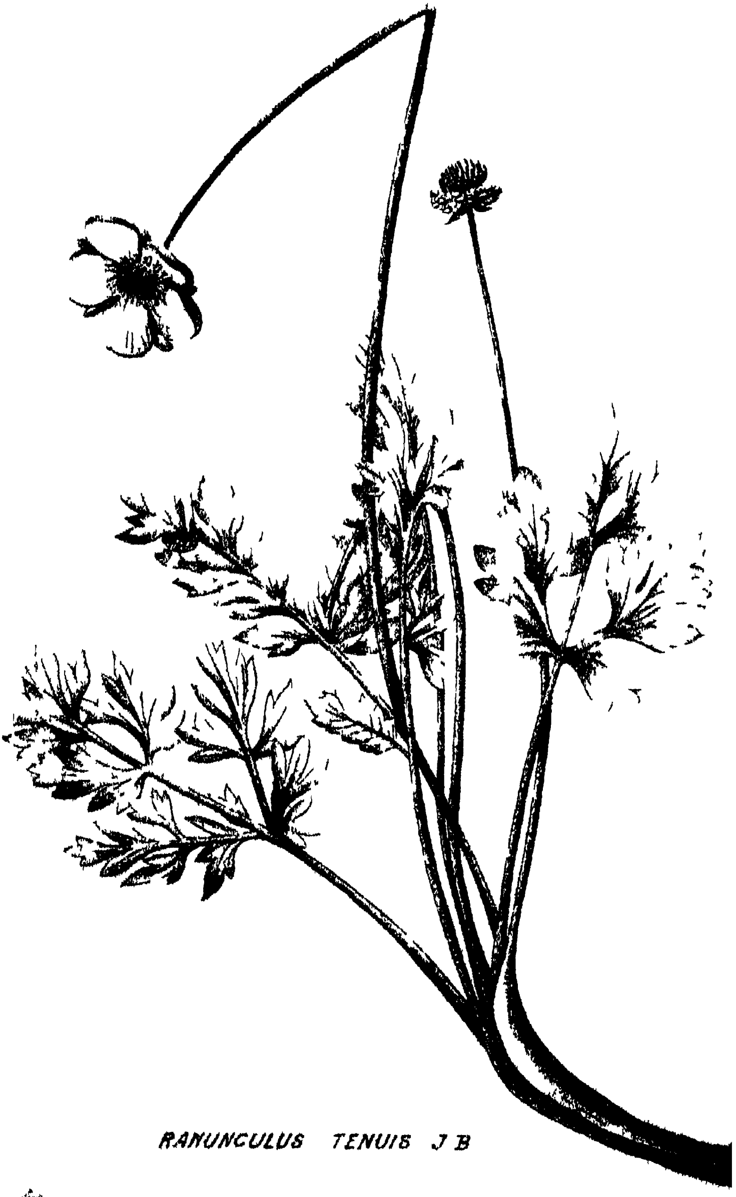

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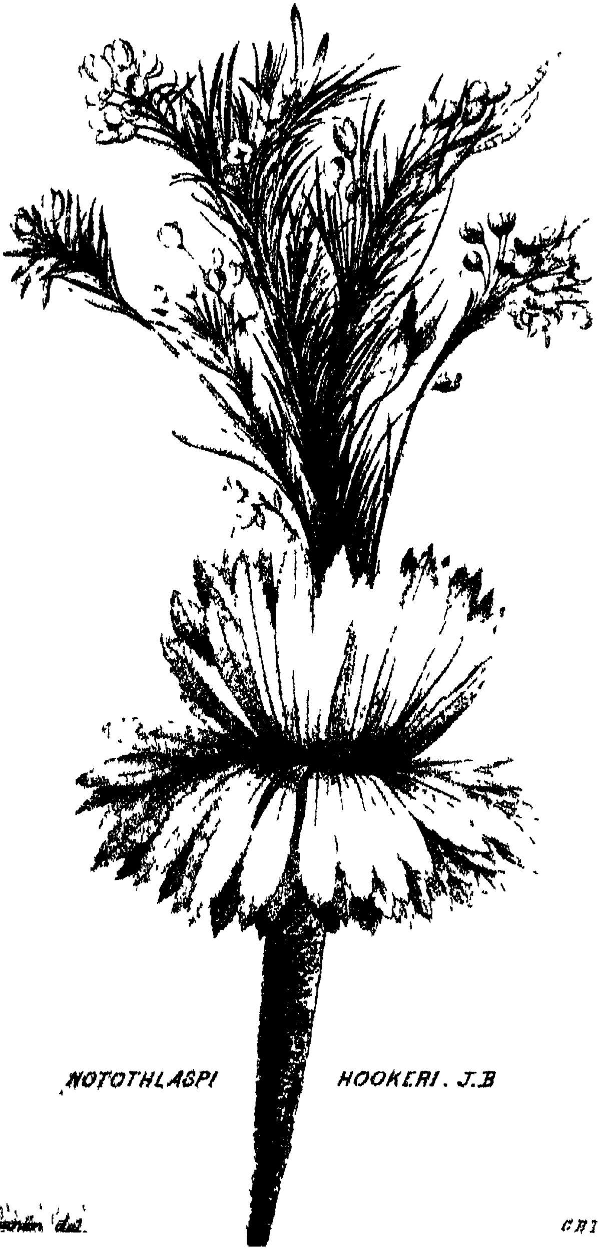

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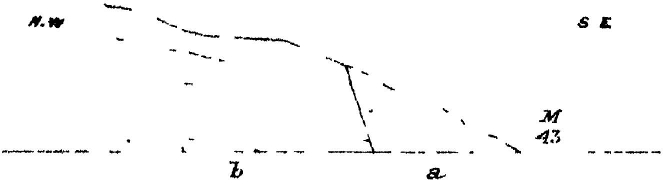

Fig I Section near 43rd Milestone

a Brown Sandstone b Conglomerates & Sandstones

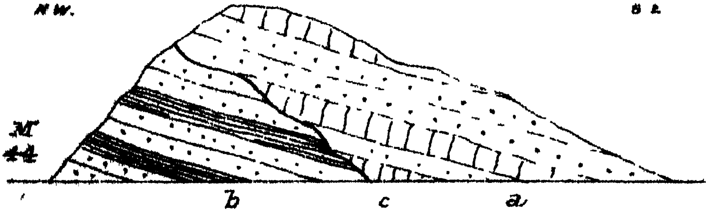

Fig 2. Section near 44th Milestone

a Mt Brown beds, b Grey Marls, c Unconformity.

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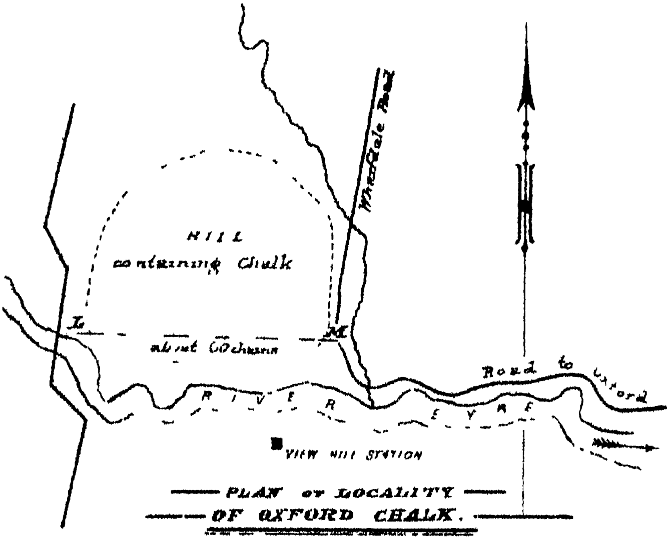
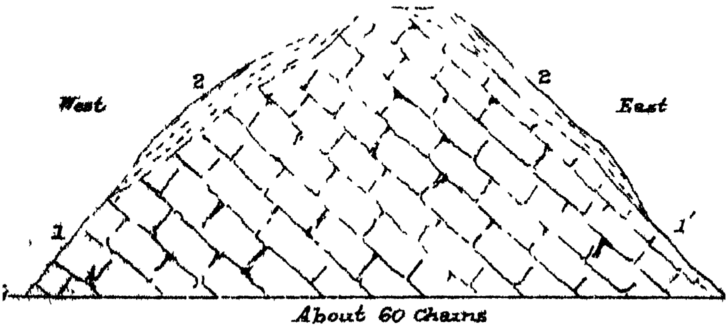


— PLAN OF LOCALITY —
— OF OXFORD CHALK. —



— SECTION ON LINE L.M. —

— REFERENCE. —

1 Marl — containing	1' Chalk — containing
T. Williamsoni	T. Williamsoni
T. Fischeri.	Terebratula (undescribed)
Cristellaria &c.	Foraminifera &c.

2 Soil — bearing Vegetation (Trees &c).

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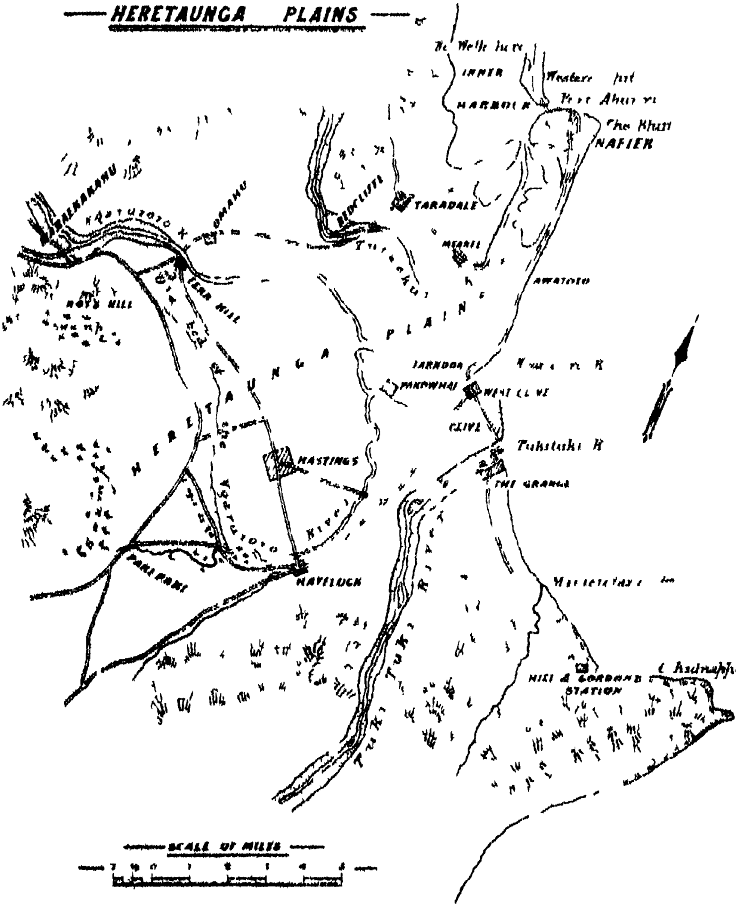
SKETCH MAP OF HERETAUNGA PLAINS



M H Gale

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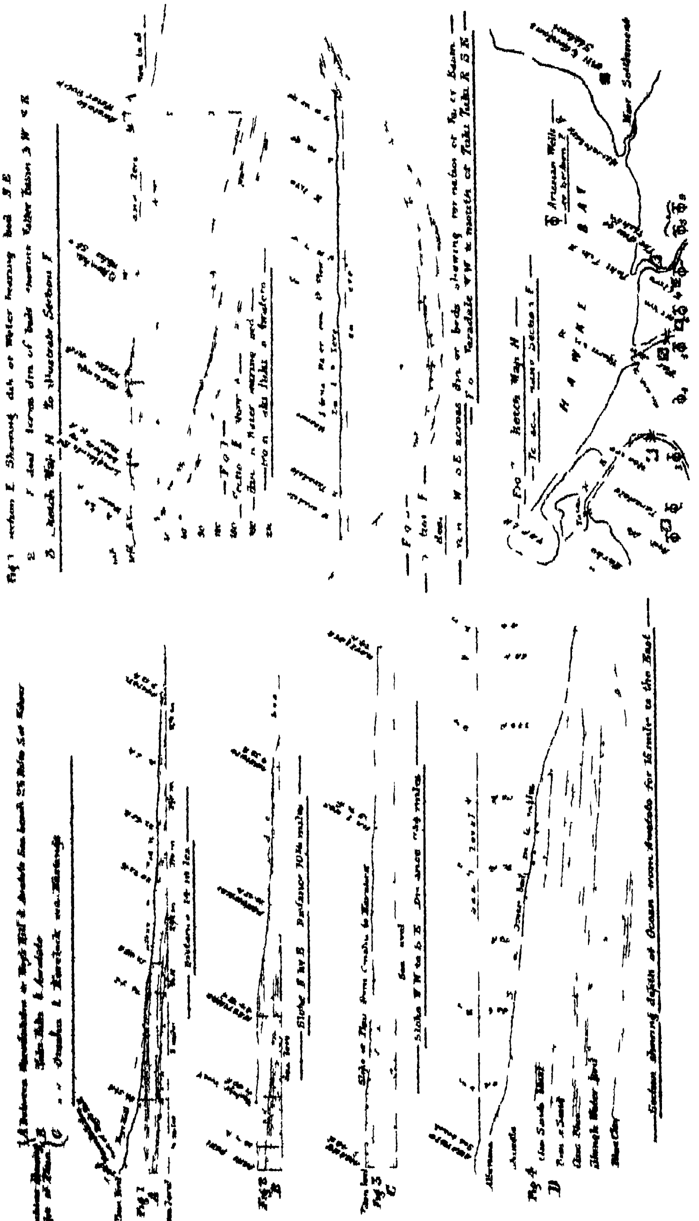
Fig 1 A
Fig 2 B
Fig 3 C
Fig 4 D
Sea Level
Distance 14 miles
Slope S by E Distance 10½ miles
Slope N W to S E Distance 13½ miles
Blue Clay
Section showing depth of Ocean from Awatoto for 15 miles to the East
Section E Showing dip of Water bearing bed S E
Sea Level
H A W K E S B A Y
Artesian Wells
West Spit
Sea Level
Sea Level

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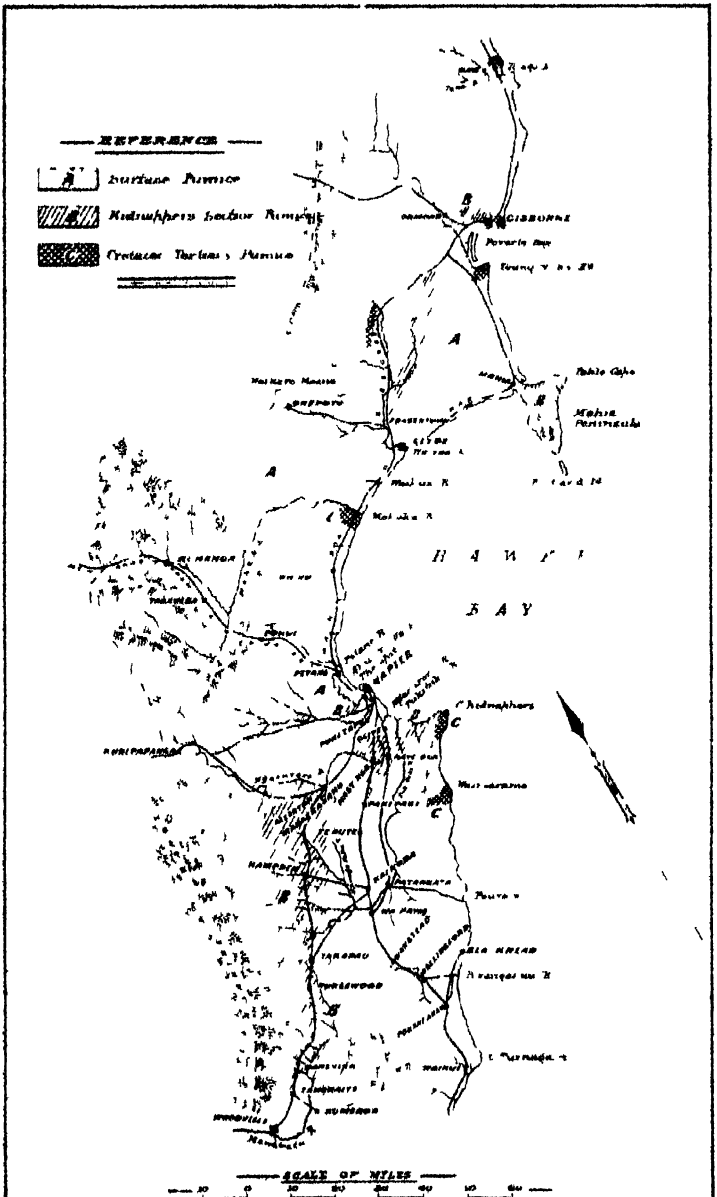

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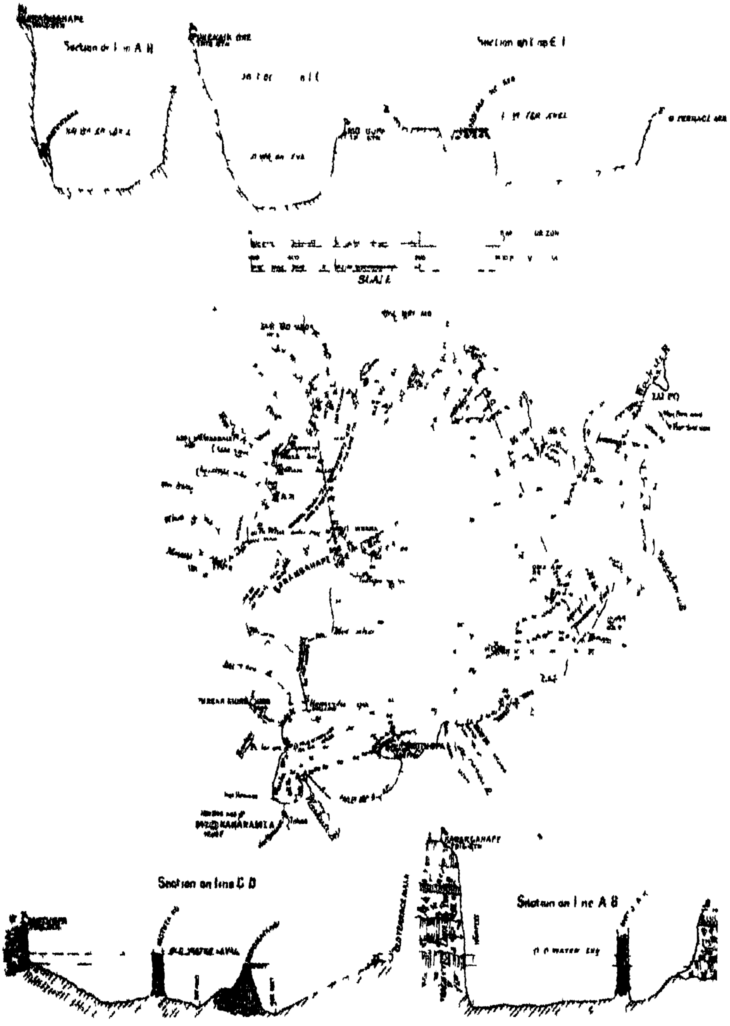

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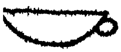
LAKE TAUPO

By L Cussen Dist Surveyor 1886

Soundings in Fathoms

SCALE OF MILES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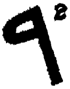
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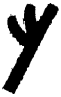
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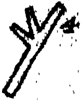
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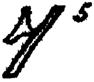
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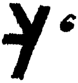
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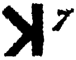
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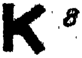
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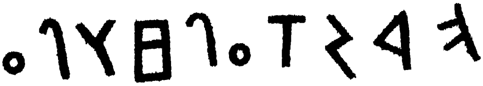
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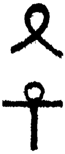
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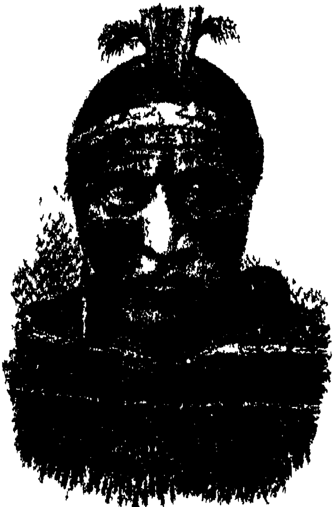
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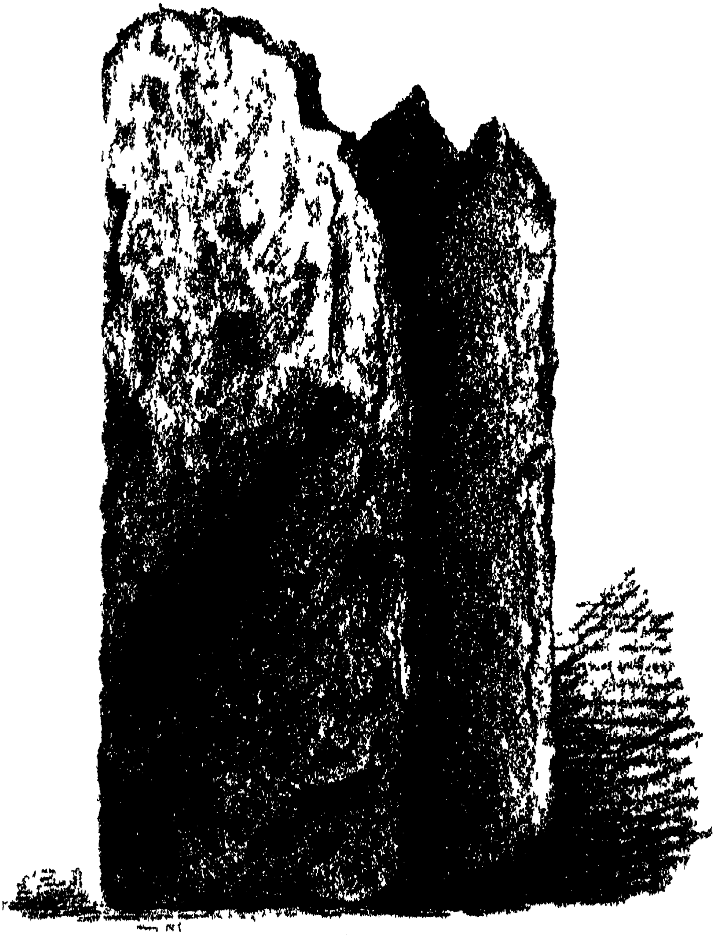

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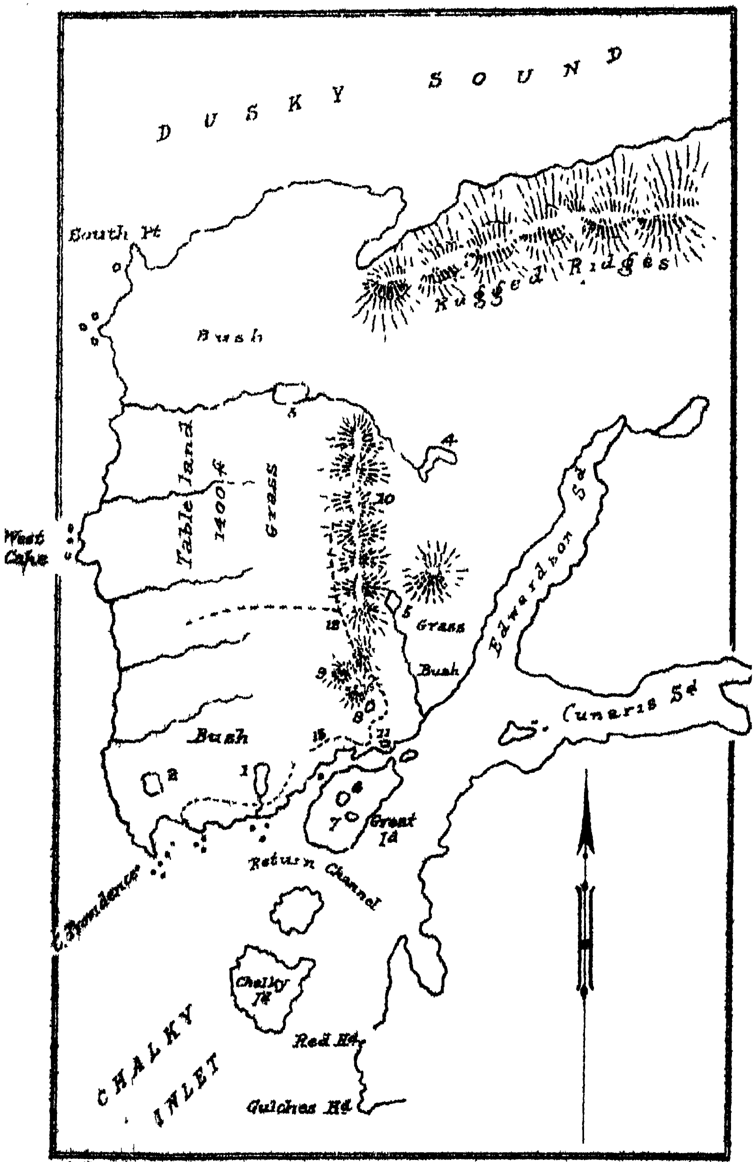

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